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MONTHLY WEATHER REVIEW

SEPTEMBER 1936

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MONTHLY WEATHER REVIEW

Editor, EDGAR W. WOOLARD

VOL. 64, No. 9
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SEPTEMBER 1936

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PRECIPITATION ON THE ISLANDS ALONG THE CHINESE COAST

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On rainfall maps of China, it may often be noticed that the yearly rainfall on the islands along the coast is less than that on the continent in their neighborhood.

Asia has a monsoon climate par excellence. In summer the rainfall is received under the influence of the summer monsoon; the southeast monsoon does not directly yield any rainfall,[1] but it is obvious that this wind is the source or reservoir of water vapor which, under certain conditions, especially when this warm and damp air mass is lifted up by relatively colder and drier northerly air currents, brings rain.

A glance at the mean annual rainfall map of China will show that the precipitation in general is much more abundant near the sea coast than in the interior of the country; but toward the very margin of the sea coast, and especially on the islands along the shore, the rainfall decreases again.

In general, the rainfall in a continental climate is concentrated in the summer season; while that of a marine climate comes mostly in autumn and winter, sometimes also in spring, but seldom in summer. In the region of a continental climate, the summer rainfall exceeds considerably that of winter; in a region of extreme continentality, the rainfall of the three summer months may form about 60 percent of the yearly total.[2] In a region of marine climate, though the rainfall is rather more abundant in winter and autumn, yet its distribution throughout the whole year is relatively even, certainly not so extreme as in the case of a continental climate. For example, Peiping is situated in latitude 39°54′ N, and Madrid in 40°24′ N; hence they lie practically in the same latitude, but because the former has a continental climate while the latter has a marine climate, their rainfall distributions through the year are quite different, as shown by table 1. Moreover, at Peiping the rainfall in each of the 8 months from October to May is less than that of Madrid in the same months; but during the remaining 4 months, June to September, the rainfall of Peiping exceeds that of Madrid enormously, and consequently the yearly total at Peiping is greater than that of Madrid.

In general, in the Temperate Zone the western part of a continent has a marine climate, and its rainfall comes mostly in autumn and winter; while the eastern part has a continental climate, and its rainfall is concentrated in summer. China is situated on the eastern side of the Eurasian continent, therefore its climate is quite continental; but the degree of continentality decreases as the coast line is approached. On the Pacific seaboard and on the islands, the climate has a more oceanic character than that of regions lying farther inland. The difference between the rainfall distributions of island and interior stations of China resembles that existing between Madrid and Peiping. The author has paired the stations on the islands with the neighboring stations on the mainland in order to compare the monthly means, as shown on the accompanying map and in table 2.

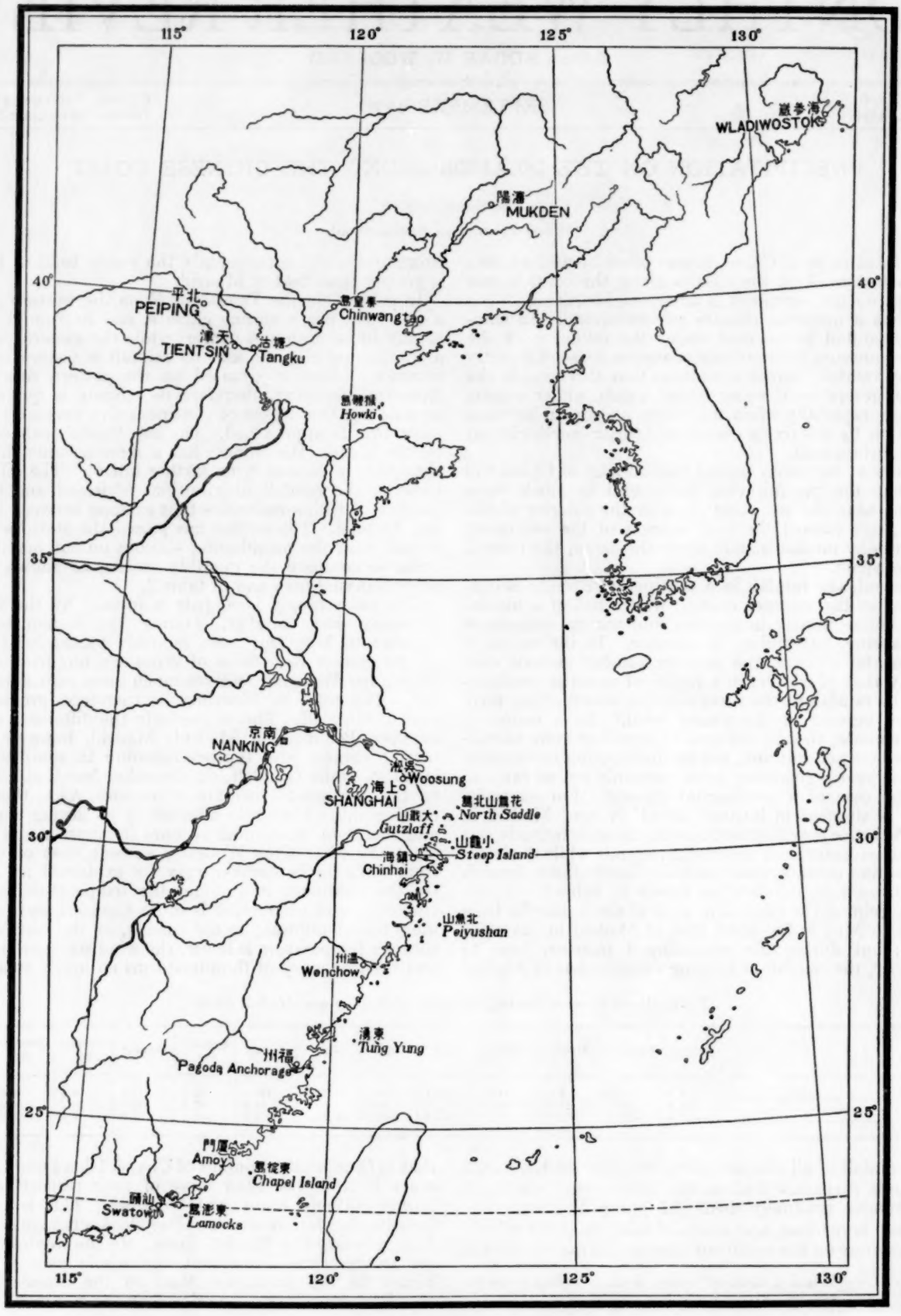
The most nearly ideal pair is formed by the stations Woosung and Gutzlaff. During the 8 months from October to May the mean monthly values for Gutzlaff are all greater than those of Woosung, but from June to September Woosung receives much more rain than Gutzlaff. The total at Woosung is, therefore, greater than that of Gutzlaff. This is precisely the difference existing between Peiping and Madrid; Madrid, however, has a marine climate and the precipitation in summer is the smallest, while Gutzlaff, on the other hand, still belongs to the continental climate of eastern Asia, though its continentality is slightly affected by its insular character; and therefore the rainfall is more in summer and spring. That the rainfall at Woosung exceeds that of Gutzlaff from June to September may be explained as follows: On the continent in summer the temperature is higher (table 3), and convection is more vigorous and produces more thunderstorms; on the islands, on the contrary, the summer temperature is lower, the wind stronger (table 4), and the frequency of thunderstorms naturally smaller.

TABLE 1.—*The mean monthly rainfalls of Peiping and Madrid (mm)*

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Peiping	4.1	4.2	9.0	16.1	33.1	82.6	255.4	146.8	57.1	17.7	8.8	2.2	637.1
Madrid	33.0	32.2	40.3	41.8	42.4	34.1	9.7	12.5	37.2	45.6	50.7	40.4	420.9
Range	−28.9	−28.0	−31.3	−25.7	−9.3	+48.5	+245.7	+134.3	+19.9	−27.9	−41.9	−38.2	+216.2

The rainfall of all seasons except summer on the northern islands surpasses that on the neighboring mainland, but decreases gradually until the group Wenchow and Peiyusban is reached, and south of this group the rainfall is always more on the continent than on the islands (except that in October the rainfalls of Chapel Island and Lamocks are a little higher than those of their respective neighboring stations Amoy and Swatow). This is probably because the stations south of Pagoda Anchorage and Tung Yung are near the Tropical Zone. In the tropical belt the air temperature throughout the whole year is always higher on the continents than on the islands in their vicinity; accordingly, the rainfall on the continent through

[1] Cochin Chu: The Enigma of Southeast Monsoon in China. Journal of the Geographical Society of China, vol. I, no. 1, p. 1, Nanking, September 1934.
[2] Hann-Süring: Lehrbuch der Meteorologie, 4th Ed., p. 366, Leipzig, 1926.


115°
120°
125°
130°
40°
35°
30°
25°
WLADIWOSTOK
MUKDEN
PEIPING
TIENTSIN
Tangku
Chinwangtao
Howki
NANKING
Woosung
SHANGHAI
North Saddle
Gutzlaff
Steep Island
Chinhai
Peiyushan
Wenchow
Tung Yung
Pagoda Anchorage
Amoy
Chapel Island
Swatow
Lamocks

the whole year is more abundant than on the islands. In the Temperate Zone, in summer the air temperature on the continent is higher than that on the ocean, and vice versa in winter; and the relative rainfall distribution follows a like variation, i. e., in summer more rain falls on the continent than on the islands, and conversely in winter.

Although air over islands is in general relatively humid, yet unless some influence acts to make it rise, appreciable precipitation cannot be produced;[3] and consequently, on the islands along the Chinese coast the opportunities for rain formation are in general much more limited than on the continent. Even in summer the temperature on the islands is always lower than on the continent (table 3), and the wind force on the islands is also stronger (table 4), whence the chances for extensive vertical convection and consequent production of thunderstorms are lessened. The islands are farther away from the center of the continent, and cold continental air currents, which might underrun the warm air, sometimes fail to reach them, or become weakened before reaching them. The altitude of the islands is generally not very great, and behind them there are no high mountains or steep cliffs; the southeasterly air current can easily pass over them, without being forced to ascend to higher levels.

Along the Chinese coast the distribution of rainfall is closely related to the local temperature. Where temperature is high, rain is generally plentiful; where temperature is low, rainfall is scanty. In table 2 it is shown that rainfall increases from north to south, both on the islands and on the continent; the temperatures show the same trend (table 3). Moreover, the yearly mean temperatures at stations on the continent are usually higher than those on the islands in their vicinity; similarly the mean yearly precipitations are higher on the continent. In the subtropical belt the rainfall on the islands for all seasons except summer is generally more plentiful than on the continent; it should therefore be expected that the temperature on the islands during all seasons other than summer should be higher than on the continent. From table 3 this is found to be true in general, though there are some discrepancies. The group Peiping and Chinwangtao does not conform to the rule; but for the other groups, from north of Mukden and Vladivostok southward to Chinhai and Steep Island the mean monthly temperatures on the islands from September to February are higher than those on the continent in their neighborhood. South of Chinhai and Steep Island there is no such relation; the monthly mean temperatures on the continent through the whole year all are higher than on the islands, except that in November the mean temperature of Lamocks is a little higher than at Swatow. The monthly rainfalls on the continent from Pagoda Anchorage and Tung Yung southward are always more than on the islands.

From the above discussion it is clear that the precipitation along the seaboard of China is more or less controlled by the temperature; this seems also to be true in other parts of the world where conditions are similar. The yearly mean temperatures on islands in either temperate or tropical regions are generally lower than those on the seaboard of a continent, and this explains why the yearly rainfall on the islands in these regions is always less than on the coast. In Germany and France similar phenomena occur in the coastal regions;[4] in Java the same condition also prevails.[5] Therefore the hypothesis that the low mean annual rainfall on the islands off the Chinese coast as compared with neighboring stations on the mainland is due to their comparative low temperature seems to be well founded.

Hellmann discovered from the weather records of 13 years at Schleswig-Holstein, Germany, that in the colder half year (October to March) there is more rainfall on the coastal belt than at inland stations; the reverse is true in summer. The difference in rainfall between coastal and inland stations is greater in the summer half year than in the colder half year. On the lighthouse of Anrum the winter rainfall exceeded that at Wyk on Föhr Island by more than 8 mm; but in summer, on the contrary, the former had 34 mm less than the latter. In Germany another example is provided by Westerland on Sylt Island, and Tondern, lying 13 km inland; in summer the rainfall of Tondern exceeds that at Westerland by 85 mm; in winter Tondern receives 49 mm less. In France at Gascogne, Languedoc, Dunkerque and Vendée, and along the coastal regions of Belgium, the same relations exist. Table 5 shows the seasonal distribution of rainfall in the district of Dunkerque, where the rainfall increases in all seasons of the year with increasing distance from the sea.

[3] Coching Chu: The Climatic Factors of China. Journal of the Geographical Society of China, vol. II, no. 2, p. 16, Nanking, June 1935.

[4] Hellmann: Über die relative Regenarmuth der deutschen Flachküsten. Sitzgsber. der K. pr. Akad. der Wissenschaften, Band LIV, 1904; Niederschläge in den norddeutschen Stromgebieten, Berlin 1906.
M. R. Blanchard. La pluviosité de la plaine du nord de la France. Annales de Géographie, vol. 11, 1902.
M. Sorre, Régime pluviométrique de la Vendée. Annales Géographie, vol. 13, 1904.
Goutereau. Distribution des pluies sur les plaines maritimes. Annuaire de Soc. Meteor., 1905.

[5] Niemeyer. De regenval de vlakke kusten van Java, Leiden, 1906.

TABLE 2.—*Comparison of rainfall on continental and insular stations (mm)*

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Mukden	4	7	18	29	55	87	147	135	85	38	22	5	632
Vladivostok	7	9	16	31	50	70	77	110	112	46	29	13	570
Difference	−3	−2	+2	−2	+5	+17	+70	+25	−27	−8	−7	−8	+62
Peiping	4.1	4.2	9.0	16.1	33.1	82.6	235.4	146.8	57.1	17.7	8.8	2.2	637.1
Chinwangtao	3.1	2.8	14.9	17.2	63.5	68.6	177.9	193.9	68.3	20.1	12.2	3.1	645.6
Difference	+1.0	+1.4	−5.9	−1.1	−30.4	+14.0	+77.5	−47.1	−11.2	−2.4	−3.4	−.9	−8.5
Tientsin	4.3	2.9	9.1	16.2	27.0	59.8	180.4	147.8	47.6	15.2	10.6	4.0	524.9
Howki	4.5	7.1	8.5	20.6	34.0	55.3	136.8	102.7	52.3	20.3	17.1	4.9	464.1
Difference	−.2	−4.2	+.6	−4.4	−7.0	+4.5	+43.6	+45.1	−4.7	−5.1	−6.5	−.9	+60.8
Tangku	4.5	3.1	8.4	11.9	29.8	66.0	176.0	140.0	42.0	13.6	11.7	2.8	509.8
Howki	4.5	7.1	8.5	20.6	34.0	55.3	136.8	102.7	52.3	20.3	17.1	4.9	464.1
Difference	0	−4.0	−.1	−8.7	−4.2	+10.7	+39.2	+37.3	−10.3	−6.7	−5.4	−2.1	+45.7
Woosung	38.4	48.2	68.9	83.7	81.1	172.1	148.1	119.0	122.5	50.7	49.9	36.4	1,019.0
Gutzlaff	45.6	58.0	87.0	91.7	83.0	144.3	90.4	66.6	111.4	61.4	50.2	38.4	928.0
Difference	−7.2	−9.8	−18.1	−8.0	−1.9	+27.8	+57.7	+52.4	+11.1	−10.7	−.3	−2.0	+91.0

TABLE 2.—*Comparison of rainfall on continental and insular stations (mm)*—Continued

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Wenchow	48.0	89.9	125.6	143.4	187.6	263.1	200.4	252.7	213.0	87.4	55.5	43.1	1,709.7
Peiyushan	49.7	86.5	107.2	107.0	127.4	157.4	74.0	105.5	171.0	61.8	56.7	55.3	1,159.5
Difference	−1.7	+3.4	+18.4	+36.4	+60.2	+105.7	+126.4	+147.2	+42.0	+25.6	−1.2	−12.2	+550.2
Pagoda Anchorage	44.5	92.3	118.8	126.4	151.0	195.7	167.0	199.6	205.9	46.8	41.2	47.7	1,436.9
Tung Yung	22.0	60.2	77.8	78.0	114.2	115.2	54.9	84.6	83.9	35.7	23.9	19.4	769.8
Difference	+22.5	+32.1	+41.0	+48.4	+36.8	+80.5	+112.1	+115.0	+122.0	+11.1	+17.3	+28.3	+667.1
Amoy	34.5	68.1	91.4	133.4	169.5	174.6	126.9	161.4	109.9	37.4	33.4	35.1	1,175.6
Chapel Island	33.1	59.7	89.9	127.6	130.2	135.0	114.1	113.4	88.1	41.3	31.0	29.4	992.8
Difference	+1.4	+8.4	+1.5	+5.8	+39.3	+39.6	+12.8	+48.0	+21.8	−3.9	+2.4	+5.7	+182.8
Swatow	34.9	58.4	84.2	146.0	216.0	256.4	205.6	213.9	133.1	62.2	42.8	36.8	1,490.5
Lamocks	27.8	34.6	59.8	100.8	117.4	165.0	170.4	147.7	120.9	74.1	26.7	23.6	1,068.8
Difference	+7.1	+23.8	+24.4	+45.2	+98.6	+91.4	+35.2	+66.2	+12.2	−11.9	+16.1	+13.2	+421.7

TABLE 3.—*Comparison of temperatures at continental and insular stations (° C.)*

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Mukden	−13.3	−10.0	−1.3	8.3	15.6	21.4	24.7	23.6	16.3	9.1	−1.6	−10.0	6.8
Vladivostok	−13.7	−10.1	−3.1	4.5	9.5	13.8	18.1	20.6	16.5	9.3	−.5	−9.6	4.6
Difference	+.4	+.1	+1.8	+3.8	+6.1	+7.6	+6.6	+3.0	−.2	−.2	−1.1	−.4	+2.2
Peiping	−4.5	−1.5	5.1	13.8	20.3	24.7	26.4	25.3	20.1	12.5	4.0	−2.7	11.9
Chinwangtao	−6.1	−4.5	1.7	9.4	15.8	20.7	24.5	24.2	19.7	12.3	3.6	−1.7	9.9
Difference	+1.6	+3.0	+3.4	+4.4	+5.5	+4.0	+1.9	+1.1	+.4	+.2	+.4	−1.0	+2.0
Tangku	−4.4	−2.4	4.2	12.2	19.4	23.9	26.7	25.7	21.5	13.8	4.3	1.7	11.9
Howki	−2.3	−2.1	2.3	8.4	14.8	19.2	22.9	23.9	21.1	15.1	7.6	1.2	11.2
Difference	−2.1	−.3	+1.9	+3.8	+4.6	+4.7	+3.8	+1.8	+.4	−1.3	−3.3	+.5	+.7
Shanghai	3.3	4.0	7.8	13.4	18.6	22.9	26.8	26.8	22.7	17.4	11.1	5.6	15.0
North Saddle	5.5	5.6	8.5	12.8	17.3	21.6	25.9	26.8	23.3	19.2	14.2	9.6	15.9
Difference	−2.2	−1.6	−.7	+.6	+1.3	+1.3	+.9	0	−.6	−1.8	−3.1	−4.0	−.9
Woosung	4.1	4.5	8.6	13.9	19.1	23.2	27.1	27.5	23.4	18.1	12.2	7.7	15.9
Gutzlaff	4.4	4.5	7.9	12.5	17.1	21.6	25.7	26.9	23.5	19.1	13.6	8.6	15.4
Difference	−.3	0	+.7	+1.4	+2.0	+1.6	+1.4	+.6	−.1	−1.0	−1.4	−.9	+.5
Chinhai	4.4	5.2	9.2	14.6	19.4	23.5	27.8	27.8	23.8	18.6	13.1	8.1	16.3
Steep Island	5.9	5.5	8.8	13.0	17.5	22.0	26.0	27.3	24.2	20.2	14.9	10.1	16.3
Difference	−1.5	−.3	+.4	+1.6	+1.9	+1.5	+1.8	+.5	−.4	−1.6	−1.8	−2.0	0
Wenchow	7.2	8.1	11.8	17.0	21.5	25.4	29.1	29.5	25.7	20.6	15.6	11.4	18.6
Peiyushan	6.3	6.2	9.2	13.6	18.4	22.6	26.6	27.2	24.3	19.9	15.2	10.5	16.7
Difference	+.9	+1.9	+2.6	+3.4	+3.1	+2.8	+2.5	+2.3	+1.4	+.7	+.4	+.9	+1.9
Pagoda Anchorage	10.5	10.3	15.8	18.5	23.0	26.2	28.4	28.5	26.1	21.9	17.6	14.0	20.1
Tung Yung	9.1	8.5	11.2	15.7	19.6	24.0	26.8	27.2	25.3	21.1	17.0	13.1	18.2
Difference	+1.4	+1.8	+4.6	+2.8	+3.4	+2.2	+1.6	+1.3	+.8	+.8	+.6	+.9	+1.9
Amoy	13.6	13.1	15.4	19.8	24.5	27.0	29.0	28.9	27.8	24.2	20.1	16.6	21.7
Chapel Island	12.2	11.3	13.4	17.9	22.6	25.6	27.3	27.3	26.5	22.7	18.8	15.4	20.1
Difference	+1.4	+1.8	+2.0	+1.9	+1.9	+1.4	+1.7	+1.6	+1.3	+1.5	+1.3	+1.2	+1.6
Swatow	13.6	13.6	15.8	20.6	25.0	27.3	28.3	28.3	26.9	23.3	19.1	16.4	21.5
Lamocks	13.1	12.3	14.4	19.5	23.5	25.5	26.7	26.5	26.1	23.0	19.3	16.1	20.3
Difference	+.5	+1.3	+1.4	+1.1	+1.5	+1.8	+1.6	+1.8	+.8	+.3	−.2	+.3	+1.2

TABLE 4.—*Comparison of wind force at continental and insular stations (Beaufort scale)*

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Tangku	1.6	1.6	1.9	2.0	1.8	1.7	1.3	1.1	1.3	1.5	1.6	1.4	1.6
Howki	3.2	3.0	3.1	2.9	2.5	2.2	2.1	2.0	2.5	2.8	3.1	3.2	2.7
Difference	−1.6	−1.4	−1.2	−.9	−.7	−.5	−.8	−.9	−1.2	−1.3	−1.5	−1.8	−1.1
Woosung	2.1	1.9	1.9	1.9	1.9	1.8	2.1	1.9	1.8	1.8	1.5	1.9	1.9
Gutzlaff	3.6	3.2	3.2	3.1	2.9	2.7	3.1	2.8	2.9	3.1	2.9	3.6	3.1
Difference	−1.5	−1.3	−1.3	−1.2	−1.0	−.9	−1.0	−.9	−1.1	−1.3	−1.4	−1.7	−1.2
Chinhai	1.8	1.9	1.5	1.7	1.5	1.2	1.6	1.5	1.7	1.9	1.6	1.6	1.6
Steep Island	3.5	3.0	2.9	2.6	2.5	2.4	2.7	2.4	2.9	3.0	2.9	3.1	2.8
Difference	−1.7	−1.1	−1.4	−.9	−1.0	−1.2	−1.1	−.9	−1.2	−1.1	−1.3	−1.5	−1.2

TABLE 4.—*Comparison of wind force at continental and insular stations (Beaufort scale)*—Continued

	January	February	March	April	May	June	July	August	September	October	November	December	Year
Wenchow	1.4	.9	.9	2.4	2.0	.7	1.4	1.3	1.0	1.2	1.0	1.1	1.4
Peiyushan	4.2	3.9	3.2	2.6	2.6	2.3	2.8	2.7	3.1	3.5	3.3	3.7	3.2
Difference	−2.8	−3.0	−2.3	−.2	−.6	−1.6	−1.4	−1.4	−2.1	−2.3	−2.3	−2.6	−1.8
Pagoda Anchorage	1.4	1.4	1.4	1.2	1.4	1.3	1.6	1.6	1.6	1.8	1.8	1.7	1.5
Tung Yung	4.0	3.8	3.5	3.4	3.1	3.2	3.7	3.4	3.5	4.0	3.9	3.8	3.5
Difference	−2.6	−2.4	−2.1	−2.2	−1.7	−1.9	−2.1	−1.8	−1.9	−2.2	−2.1	−2.1	−2.0
Amoy	2.8	2.6	2.6	2.4	2.5	2.6	2.6	2.5	2.6	2.9	2.7	2.6	2.6
Chapel Island	4.2	4.0	3.6	2.8	2.9	2.8	2.4	2.4	3.3	4.5	4.2	4.0	3.5
Difference	−1.4	−1.4	−1.0	−.4	−.4	−.2	+.2	+.1	−.7	−1.6	−1.5	−1.4	−.9
Swatow	1.9	2.1	1.8	1.8	1.8	1.8	1.8	1.8	2.0	1.8	1.8	1.8	1.8
Lamocks	4.0	3.8	3.7	3.1	2.8	2.6	2.3	2.3	3.3	4.4	4.1	3.8	3.4
Difference	−2.1	−1.7	−1.9	−1.3	−1.0	−.8	−.5	−.5	−1.3	−2.5	−2.3	−2.0	−1.6

TABLE 5

Stations	Distance from the sea	Altitude	Winter	Spring	Summer	Autumn	Year
	km	m	mm	mm	mm	mm	mm
Dunkerque	0	7	110	96	147	188	541
Les Moeres	5	1	133	122	180	227	662
Bergues	10	7	143	124	178	228	673
Steene	10	8	150	114	164	215	643
Wormhoudt	20	17	150	128	192	249	719
Nordpeene	25	20	153	147	196	247	743

CLIMATE OF THE ROGUE RIVER VALLEY, OREG.

By WILLIS B. MERRIAM

[Department of Geography, University of Washington, Seattle, Wash., September 1936]

The Rogue River Valley represents an area of about 300 square miles, carved out of the Klamath Plateau of southwestern Oregon by the Rogue River and its major tributaries. The elevation of the arable valley floor ranges from slightly under 1,000 feet at Grants Pass to 2,000 feet in the upper Bear Creek Valley, southeast of Ashland. The region is surrounded on all sides by mountains that rise to elevations of from 4,000 to 7,000 feet.

The economic basis of the Rogue River valley consists largely of general farming of a rather intensive nature, some mining, and an increasing health resort and tourist business. Its agricultural specialization consists of pears; it is one of the largest three commercial pear-producing regions in the United States.

So much of the economic development of the valley depends upon its distinctive climatic conditions that a résumé of the climatological environment is prerequisite to an understanding of the region.

RAINFALL

Climatically the Rogue River Valley is located in the southern part of the north Pacific climatic province; that is, it represents the more arid phase of the Marine Temperate or West Coast Cyclonic type. The American Mediterranean lies to the south in central and southern California and the Arid Continental lies to the east in the lee of the Cascade Mountains. Because it is situated some 60 to 100 miles inland, with a mountain interval between the valley and the coast, certain characteristics of both a subtropical and a continental nature are in evidence. Many of the older homes in Medford and Ashland have palm trees in their yards. They are not too vigorous in appearance, to be sure, nevertheless palm and pine meet in the Rogue River Valley, and at least two pomegranate trees have weathered some 30 or 40 years in the town of Jacksonville.

The maximum rainfall occurs in winter when the mild, moisture-laden winds from the Pacific blow across the cooler lands. The annual precipitation may be as heavy as 40 to 80 inches in the surrounding mountains; but the fact that the agricultural sections in the valleys lie from 2,000 to 6,000 feet lower than the surrounding territory, places the entire region within the rain-shadow of the ranges, definitely reducing the amount of precipitation that might otherwise be expected, and resulting, in fact, in a dry valley island within the Klamath Plateau. Down in the valley proper the average annual rainfall runs from 25 to 30 inches near Grants Pass where a considerable orographic precipitation carried over from the coastal mountains is still in evidence, to around 15 at Medford, the center of the "island."

The minimum rainfall occurs in summer. Except for occasional light convectional showers July and August are practically rainless. There are several reasons for the summer drought conditions. During the summer months a dominant anticyclonic area, the Cape Mendocino HIGH, lies off the coast in the north Pacific. Winds blowing outward on the eastern side of this HIGH have little opportunity to take up moisture before reaching the coast. Furthermore, during the summer the land becomes warmer than the ocean. The winds tend to warm up as they progress over the land, increasing the vapor capacity, and hence they are drying winds rather than moisture-giving winds. This tendency is further aggravated by the fact that the valley areas receive a great deal of insolation as the sun blazes down through cloudless skies, causing temperature to soar during the day. The result

is that the winds unduly increase in temperature as they progress through the valley. Although local convection must be great, thunderstorms are not common, as the Rogue River Valley appears to be dominated by the greater convectional low pressure of the central California valleys and the permanent summer LOW that lies over the arid southwest. The valley winds, in other words, are drawn southward and southeastward instead of being allowed to ascend over the area; furthermore, because of the relative dryness of the air, the convection that does occur does not carry it high enough to reach condensation temperatures.

TEMPERATURES

According to Ellsworth Huntington, a month is cooler than is ideal if its average temperature falls below 32° F.; and warmer than ideal if the temperature averages above 70°. The Rogue River Valley fits well into this optimum temperature range. The mean annual temperature for the valley proper ranges between 52° and 53°, with extremes at Medford, 110° and −10°, respectively. Zero temperatures are rare; and the mean for January, the coldest month of the year, is between 37° and 39°.

Summers are hot. The means for July and August range between 69° and 71°. However, the hottest spells usually last but a week or so; and although general high temperature prevails, the humidity is low and the sensible temperature is not excessive. It is only with the passing of a cyclonic storm, resulting in an increased humidity, that the temperature becomes in the least oppressive, and that condition lasts but a few hours. Because of the cloudless skies, which facilitate rapid radiation, and the nocturnal drainage of cooler mountain air into the valley basins, nights in summer are always cool. This coolness lasts well into the morning, until the regular winds spring up and solar heat warms up the passing air.

The combination of mild winters, frequent temperature changes, warm to hot days in summer, but delightfully cool evenings and nights, is undoubtedly conducive to a maximum of human energy, and the Rogue River Valley may be safely referred to as one of the most energizing geographic regions in North America.

WINDS

There are no really destructive winds or storms throughout the valley. However, strong steady winds along the Bear Creek Valley sometimes present minor problems. The prevailing winds are westerly. In winter they are dominantly cyclonic in nature; they impart a southerly component to the westerly winds during the cool season. Anticyclonic and solar controls are dominant during the summer. At this season of the year, the winds may gain considerable impetus as they blow outward from the Pacific anticyclone. In general they follow the direction of the valley, due largely to conditions of local topography. As they leave Ashland they proceed definitely south-southeast, drawn by the summer LOW of the arid southwest and by Sacramento Valley convection; this is evidenced by the fact that the hotter the day, the more steady and firm are the winds. In fact on a hot afternoon the winds are drawn southward from the Rogue River Valley with such force that they tax the capacity of a powerful car in pulling up the Siskiyou Mountains northbound. These summer afternoon winds are so important a factor locally that drivers and truckers who are familiar with conditions schedule their trips so that they will be southbound over the Siskiyous in the afternoons and northbound either in the evening or morning, to escape the strong head winds that must otherwise be encountered.

Grants Pass, lying in what might be termed the "wind shadow" of the coastal mountains, has the second lowest average wind velocity of any station in the United States. As one progresses eastward through the valley, however, the winds increase considerably in velocity. This increase, and a prevailing northwesterly direction, mean that young orchards need to be especially pruned and sometimes propped to prevent leeward leaning and excessive leeward development of the trees. The practice of establishing orchards in the lee of poplar or eucalyptus windbreaks, as is done in many prairie areas and in parts of California, offers a possible solution but as yet has not been utilized in the valley.

FROST HAZARD AND THE GROWING SEASON

In the spring of the year there is considerable frost hazard in many parts of the basin. During nights favorable for frosts, the winds die down altogether and the colder air from the highlands drains down into the valley bottoms. If the winds are associated with a passing cyclonic area, the humidity has a tendency to be somewhat higher and frost is not likely; but if the winds emanate from anticyclonic areas, the humidity is lowered and damaging frosts may occur.

As a rule it is only on the valley floor that serious injury may be caused by the low temperatures during the blooming period. Where there are slight elevations no frosts may occur, while serious injury may result only a few feet below. The hillsides surrounding the valley usually escape frosts altogether, once the normal spring season has arrived. The average variation in temperature in favor of the lands lying above the valley floor is from 5° to 6°, due to a marked inversion of the temperature gradient when cold dense air creeps in and lies in stagnant pools underneath the warmer air. P. J. O'Gara, a special weather observer, who studied the frost problem of the Rogue River Valley a number of years ago, recorded temperatures ranging as low as 23° to 25° on the ground and 32° to 35° 50 feet above. "There is at times", he reports, "a difference of 12 degrees or more between ground temperatures and 50 feet above the valley floor."

Because of this frost danger on the valley floor, most of the more recently established fruit orchards have been in along the detrital slopes where air drainage is better. Here is located the greatest orchard acreage at the present time, although several fine old orchards are still found in the lowlands. Eternal vigilance against spring frost is the price paid for these orchards, however. Without artificial protection the danger of injury by frost is greater in the lowlands of the Rogue River Valley than in most fruit growing sections of the country. This fact has caused the development of one of the best systems of orchard heating in use among fruit growers anywhere in the United States.

In spite of the early season frost hazard in certain well-spotted sections of the valley, the growing season is fairly long. The Umpqua mountains north of Grants Pass protect the region from cold north winds, and the Cascade Range stops cold easterly winds to a large extent. Ashland, Grants Pass, Jacksonville, Medford, and Talent all range from 160 to slightly in excess of 200 frost-free days. The average growing season for the valley is about 190 days.

RAINFALL VARIABILITY

One characteristic of the precipitation of this complex climatic region, and one which has played an important part in shaping the economic history of the Rogue River Valley, is its variability in amount, monthly and annually. In illustrating this time distribution, the precipitation record for Ashland has been used for the reason that Ashland has the longest record, some 54 years, plus a 12-year unofficial private record, and conditions here are typical of the entire valley. There is a noticeable difference in total precipitation from year to year. In 1907 the heaviest rainfall in the history of the station occurred, with a total of 28.87 inches. Two years previous to that record, the lowest amount was recorded, when but 11.99 inches fell during the entire year. Following the dryest year, 24.25 inches fell, more than double the amount of the previous year.

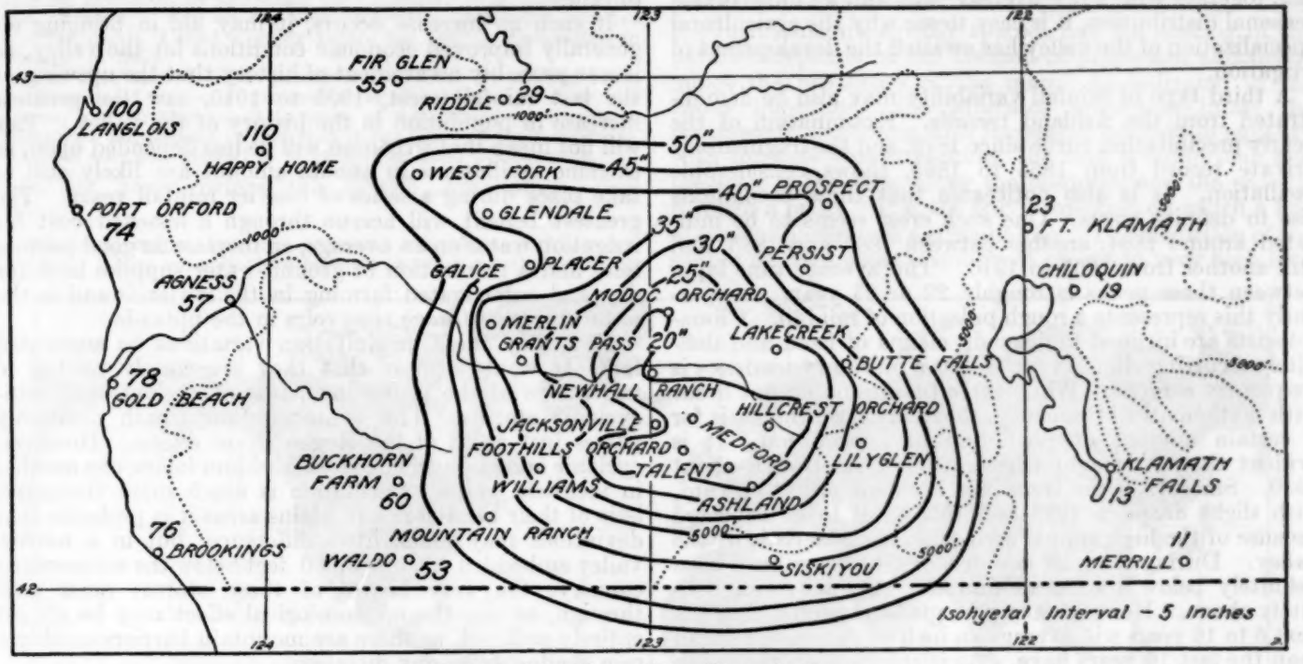


FIGURE 1.—Isohyetal map of Rogue River region, Oregon.

The monthly rainfall likewise shows this variability. In January of 1881 a total of 12.29 inches fell—more in 1

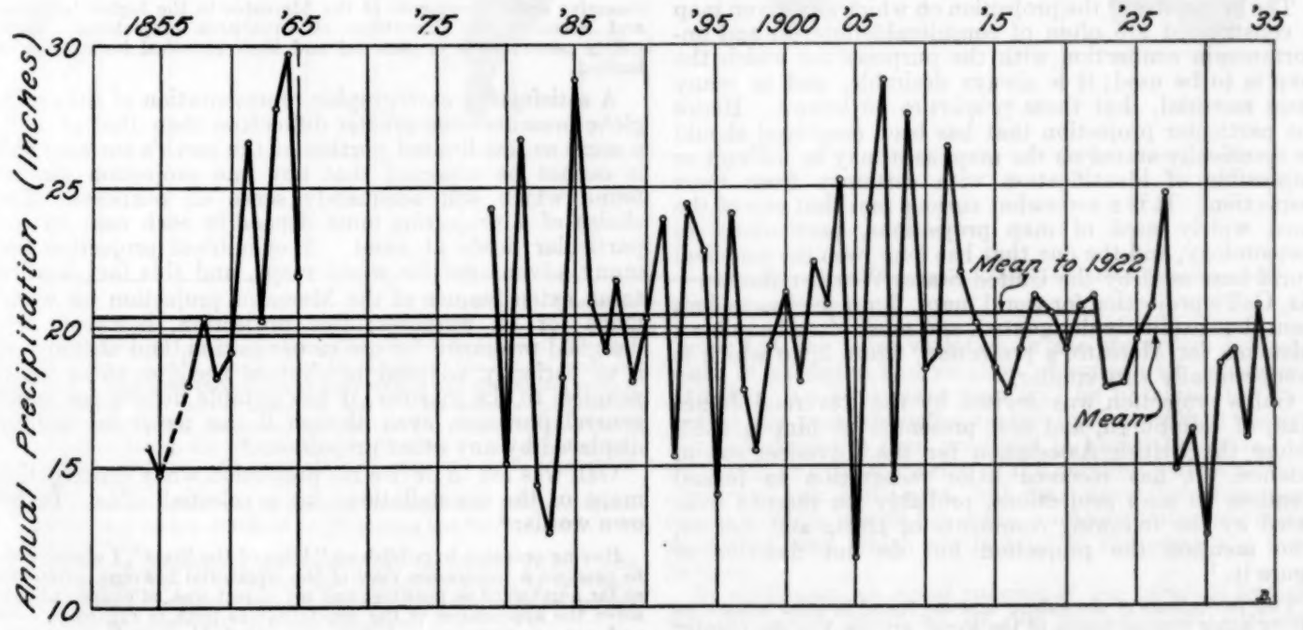


FIGURE 2.—Annual precipitation record, Ashland, Oreg.

month than in the entire dry year previously mentioned. The driest January on record received but 0.47 inch. August, ordinarily a rainless month, has had up to 2.71 inches of rain. The November amounts range from a

trace to 8.10 inches. Such fluctuations mean that the rainfall is not dependable for ordinary types of agriculture. Under natural conditions the Rogue River Valley would be an area of agricultural risk. With this variability of rainfall, together with a low average total and an unfavorable seasonal distribution, it is easy to see why the agricultural specialization of the valley has awaited the development of irrigation.

A third type of rainfall variability may also be demonstrated from the Ashland records. Examination of the yearly precipitation curve since 1879, and the fragmentary private record from 1854 to 1865, shows considerable oscillation. It is also noticeable that these oscillations rise to definite crests. One such crest seems to be indicated around 1864, another between 1880 and 1885, and still another from 1905 to 1910. The average time lapse between these peaks is roughly 22 or 23 years. Apparently this represents a rough pulsation of rainfall. Climatologists are inclined to discredit claims of fixed and definitely recurring climatic cycles, but a pulsatory tendency is frequently evident. While these pulsations do not occur with mathematical frequency, they may form the basis for a certain amount of prediction or expectation. It is evident that a drought period reached its trough about 1930. Since 1930 the trend has been somewhat upward, with slight drops in 1933 and 1935 as is to be expected because of the high annual oscillation characteristic of the valley. During the past two decades, 14 years have been definitely below the mean and only 2 have been definitely above. Hence it may perhaps be expected that the next 5 to 10 years will average an inch or two more rainfall than the last 10 years have. As it stands now, the mean for the official 44-year record for Ashland ending in 1922, and contained in the old section 17 of the Summary of Climatological Data for the United States, is indicated as 20.35. In 1935 that mean stood lowered to 19.75 inches of rain.

If such an increase occurs, it may aid in bringing on generally improved economic conditions for the valley, as it was probably no accident of history that the upswing of the last rainfall crest, 1905 to 1910, saw the greatest increase in population in the history of the valley. This will not mean that irrigation will be less depended upon, as extreme oscillations in annual amount are likely still to take place during a series of heavier rainfall years. The greatest benefit will accrue through a lessened cost for irrigation water on an average, an increase in good pasture land and a restoration of ground-water supplies both for dry and subirrigated farming in the lowlands and in the natural water-storage reservoirs in the uplands.

How may these precipitation variations be accounted for? It would appear that they are closely related to migrations of the prevailing paths of cyclonic and anticyclonic storms. The winter cyclonic path ordinarily passes just north of the Rogue River region. However, cyclonic and anticyclonic storms seldom follow one another in identical paths. Oscillation is much more characteristic of their behavior. In plains areas it is probable that deviations may make little difference; but in a narrow valley embedded 2,000 to 3,000 feet below the surrounding country, the very hearts of these storms must pass through, or else the meteorological effect may be almost entirely nullified, as there are mountain barriers casting a rain shadow from any direction.

GALL'S PROJECTION FOR WORLD MAPS

By I. R. TANNEHILL and EDGAR W. WOOLARD

[Weather Bureau, Washington, September 1936]

The properties of the projection on which any given map is constructed are often of considerable interest and importance in connection with the purposes for which the map is to be used; it is always desirable, and in many cases essential, that these properties be known. Hence the particular projection that has been employed should be specifically stated on the map, as it may be difficult or impossible of identification with certainty from mere inspection. It is a somewhat curious fact that one of the most widely used of map projections, particularly in meteorology, and the one that has long been the principal world base used by the United States Weather Bureau—viz, Gall's projection for world maps, figure 1—has seldom been thus explicitly designated, and must often have been mistaken for Mercator's projection, figure 2, to which it is superficially very similar.

Gall's projection was devised by the Reverend James Gall, of Edinburgh, and first presented by him in 1855, before the British Association for the Advancement of Science. It has received little recognition in formal treatises on map projections, probably for reasons indicated by the following comments of Deetz and Adams, who mention the projection but do not describe or figure it: [1]

> Two projections of the sphere that are found in some atlases, as giving a fair representation of the world, are the Van der Grinten projection and Gall's projection. These two projections are neither conformal nor equal-area and may be classed as intermediates, having no properties of definite scientific value. They present a fair uniformity in the configuration of the world, avoiding the excessive scale increments of the Mercator in the higher latitudes and lessening the distortions of equal-area projections. Their utility nevertheless is pictorial and their practical importance is limited.

A satisfactory cartographic representation of the entire globe presents even greater difficulties than that of only a more or less limited portion of the earth's surface; and it cannot be expected that any one projection can be found which will adequately serve all purposes. The choice of a projection must depend in each case on the particular needs at hand. A cylindrical projection has many advantages for world maps, and this fact has led to an extensive use of the Mercator projection for world maps for all purposes; this projection, however, was designed primarily for use in navigation, and although it is so perfectly adapted to nautical needs as to be *indispensable* to the mariner, it has notable defects for many general purposes, even though it can never be entirely displaced by any other projections.[2]

Gall was led to devise his projection while constructing maps of the constellations for a celestial atlas. In his own words: [3]

> Having occasion to publish an "Atlas of the Stars", I was anxious to produce a panoramic view of the equatorial heavens, extending as far northward as possible; and my object was, of course, to conserve the appearance of the constellations both in regard to form and comparative area. I first attempted Mercator's projection, but the result was not satisfactory: the orientation, indeed, was perfect, but everything else was sacrificed. It then occurred to me that if, instead of rectifying the latitude to the longitude through-

[1] C. H. Deetz and O. S. Adams, Elements of Map Projection, U. S. Coast and Geodetic Survey, Sp. Pub. 68, 4 ed., p. 182. Washington, 1934.

[2] *Cf.* Deetz and Adams, *op. cit.*, pp. 146–147, 101–104, and 34–35.

[3] James Gall: On a new projection for a map of the world, Proc. Roy. Geographical Soc., 15: 159, 1870. This paper includes a plate showing the projection.

out, we rectified it only at the forty-fifth degree, we might adopt the stereographic latitudes up to the sixtieth degree without any distortion.

It then occurred to me that the same projection would be applicable to a cylindrical map of the world, and would be a great improvement on Mercator, by extending the stereographic latitudes to the pole. I drew a map on the new projection, and being satisfied with the result, I read a paper before the British Association in Glasgow, in 1855.

Since that time I have greatly improved it by adding polar supplements of the same projection for the Arctic and Antarctic regions; and on showing it to some of my publishing friends in Edinburgh, am pleased to find that it has received their approval, and been adopted, instead of Mercator, for their publications.

In his paper before the British Association, Gall states: [4]

Cylindrical maps alone can represent the whole world in one diagram. There are only three features in which a cylindrical map can be accurate: (1) in orientation; (2) polar distance; and (3) proportion of area; but if one of these be obtained, the others must be sacrificed. The best projection is that which will divide the errors, and combine the advantages of each. Mercator's projection sacrifices form, polar distance, and proportionate area, to obtain accurate orientation for the navigator; whereas to the geographer, form, polar distance, and proportion of area are more important than orientation.

Polar distance is obtained by making the degrees of latitude equal.

Proportion of area is obtained by projecting the degrees of latitude orthographically.

In these two projections orientation can be correct at only one line of latitude; but if we select the forty-fifth degree of latitude, and make the orientation correct at that line, the error is halved on each side and the distortion less offensive.

The projection which unites all the advantages of the three, in the best proportion, is obtained by projecting the degrees of latitude stereographically, and selecting the forty-fifth degree of latitude as the line of correct orientation.

[4] James Gall: On improved monographic projections of the world, Rept. twenty-fifth meeting Brit. Assoc. Adv. Sci. at Glasgow, 1855, p. 148. London, 1856.

Gall exhibited to the British Association three new cylindrical projections suggested by the preceding remarks. Any projection on a cylinder tangent at the equator gives a map in which the meridians and parallels form two mutually perpendicular systems of parallel straight lines; the meridians are equally spaced, but the spacing of the parallels depends on the method of projection and determines the properties of the map. As indicated in the above quotations, the Mercator projection limits the north-south stretching with increasing latitude to equality with the east-west stretching; the map is conformal, and the scale is the same along the meridian and the parallel through a point. It is the only projection on which a line of constant bearing is a straight line. The distortion of the shapes of large areas is not great except in very high latitudes, but the large variation in the scale with latitude leads to excessive exaggeration of areas with increasing latitude. An equal-area map will be obtained by projecting the parallels orthographically, but violent distortions of shape are then produced in higher latitudes. A map with any other spacing of the parallels will be neither conformal nor equal-area, but may nevertheless possess characteristics which for some purposes outweigh these properties, and which are lacking in the preceding projections.

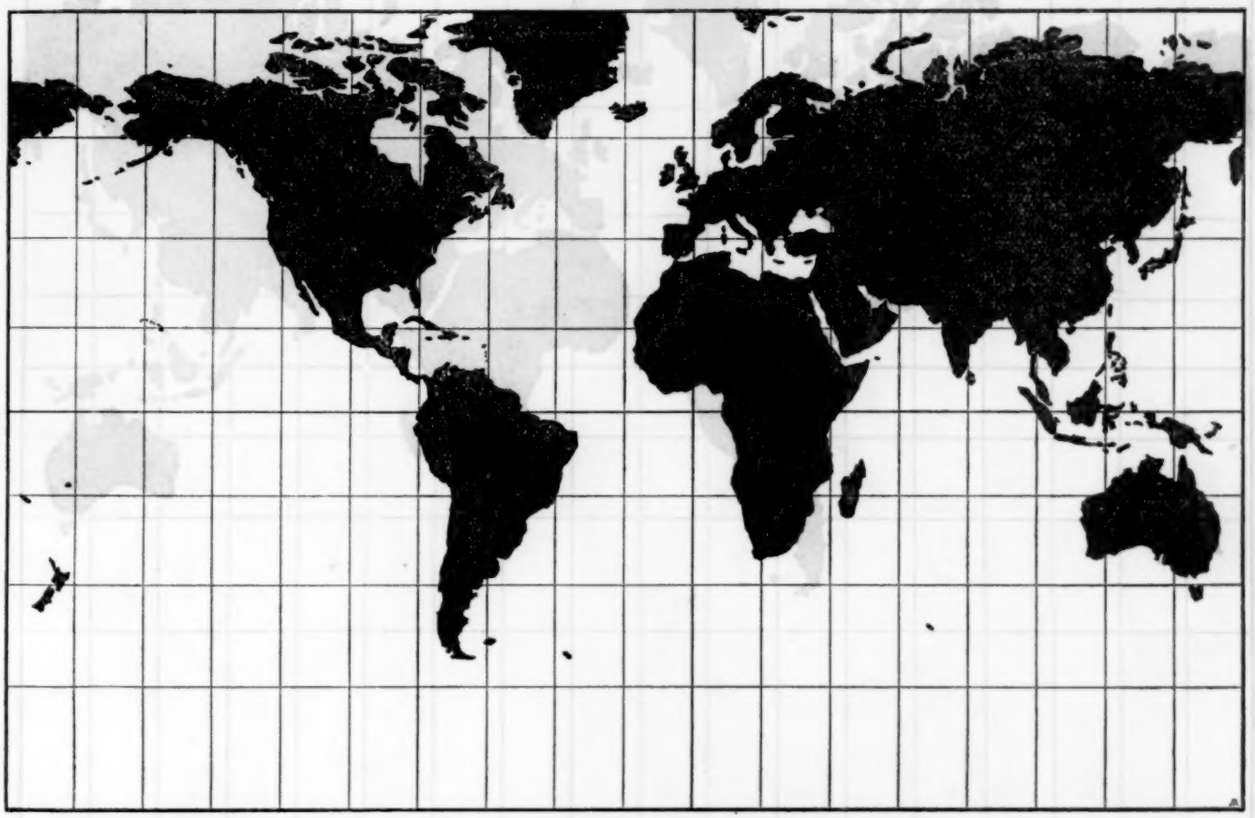


FIGURE 1.—Chart of the world on Gall's projection.

In particular, an equal spacing of the parallels lessens the distortion produced by the orthographic spacing, especially if the spacing of the parallels is made greater than that of the meridians in some appropriate ratio; and in one of the three projections proposed by Gall, the parallels are equally spaced in such a way that the latitude is rectified at the 45th parallel, giving a so-called "modified

cylindrical equal-spaced projection" with the spacings of the meridians and the parallels in the ratio of about 7 to 10;[5] this construction constitutes Gall's Isographic Projection, which Gall considered to be of value for many physical maps, especially meteorological and hydrographic. Another of the projections proposed by Gall is one in which the latitudes are projected orthographically, but are rectified at the forty-fifth parallel instead of at the equator as in the ordinary orthographic cylindrical projection; this is Gall's Orthographic Projection, which is equal-area and is valuable for some physical maps, especially statistical

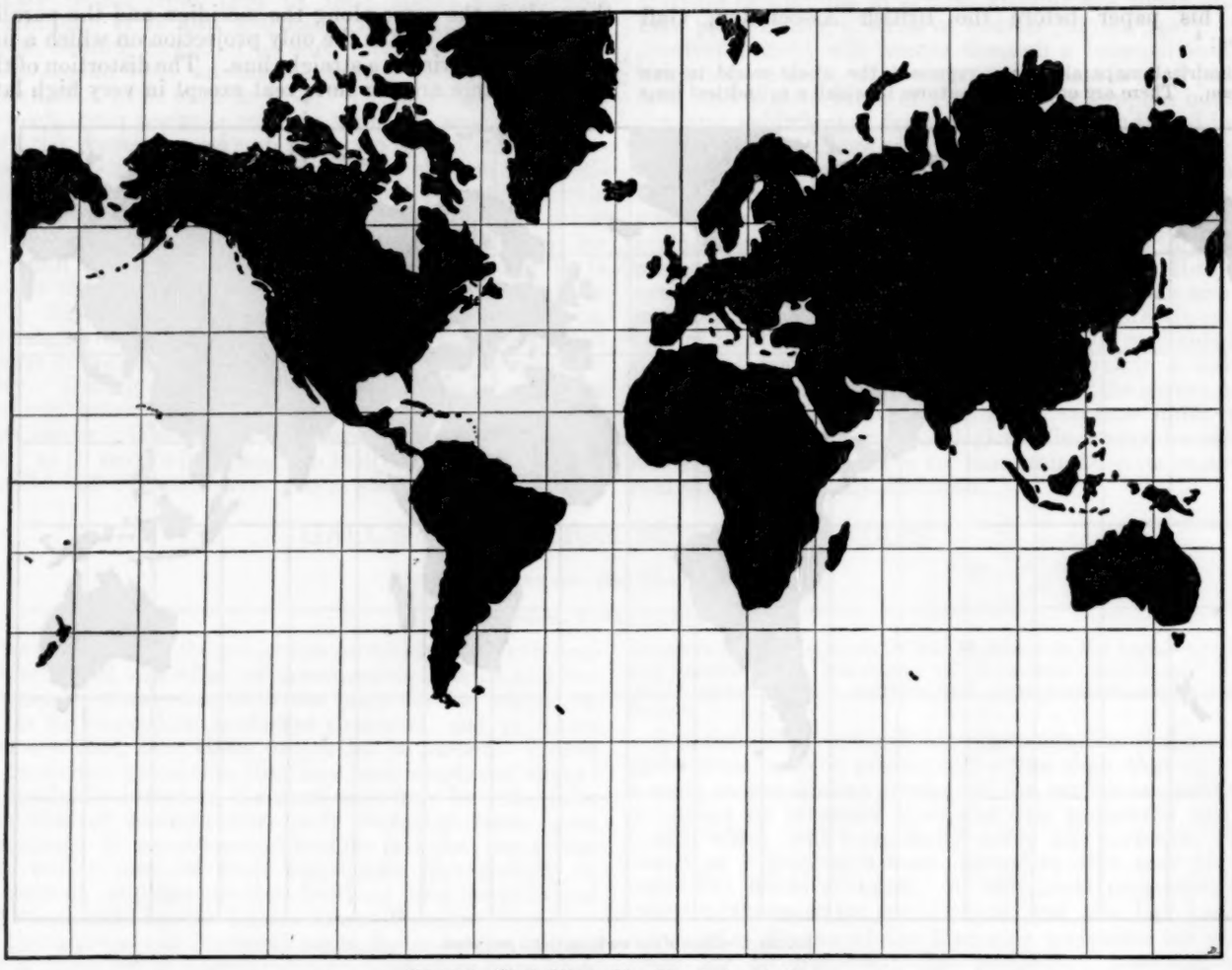


FIGURE 2.—Chart of the world on Mercator's projection.

ones, but in which the geographic features are considerably distorted.

The most generally useful of the projections devised by Gall, however, and the one referred to simply as Gall's projection, is his stereograhic projection; it is not mathematically exact in conformality, polar distance, or comparative area, but it more nearly approaches having all three properties at once than the others, and conserves geographic features better. As compared with the Mercator projection, Gall claims as its advantages that it gives a more accurate representation of geographic forms, it is capable of representing the entire globe including the poles, it represents polar distance and relative area more accurately, and it saves 25 percent of the space occupied by the Mercator map.

Gall's stereographic projection is constructed by projecting the latitudes stereographically—that is, perspectively from the point on the equator diametrically opposite the point of tangency of the cylinder—and then spacing the meridians so as to rectify the longitudinal and latitudinal scales at the 45th parallel; if r be the radius of the earth and a the length by which it is represented in the construction, then a latitudinal arc $rd\varphi$ of the earth's surface maps into a linear distance $d\left(2a \tan \frac{\varphi}{2}\right)$ on a tangent cylinder; the north-south scale at latitude φ is therefore $\frac{a}{r} \sec^2 \frac{\varphi}{2}$, whence to equalize the longitudinal and latitudinal scales at that latitude the complete parallel (of length $2\pi r \sin\varphi$) must be represented on the map by a line of length $(2\pi r \sin\varphi)\left(\frac{a}{r} \sec^2 \frac{\varphi}{2}\right) = 4\pi a \tan \frac{\varphi}{2}$. The projection may be distinguished by inspection from that of Mercator by noting the shapes of Greenland and Alaska.

[5] The length of the parallel of 45° is 0.70711 (=sin 45°) that of the equator; hence if the scale along the forty-fifth parallel is to be the same as that along a meridian at latitude 45°, a given arc of longitude will occupy only 0.70711 the linear space occupied by an equal arc of latitude, i. e., the spacings of meridians and parallels must be in the ratio 0.70711.

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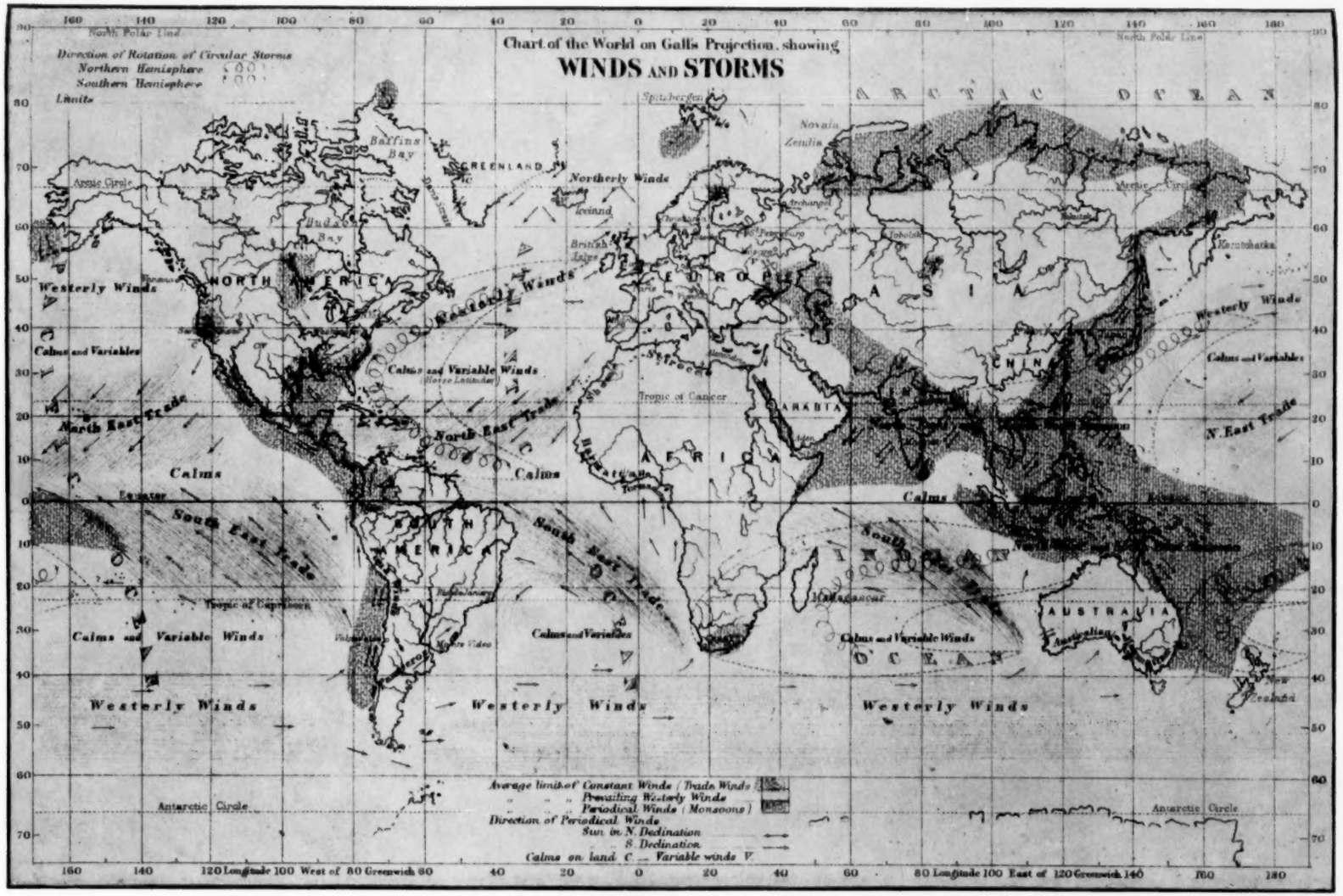

FIGURE 3.—The first published map on Gall's projection.

Gall described and figured all three of his projections in a paper [6] wherein he states:

> * * * for more than 20 years after I had exhibited the three new projections before the British association I was the only person that used them. * * *
>
> The first to adopt it [Gall's stereographic projection] was the late lamented Mr. Keith Johnston, who introduced it into his miniature atlas, which was, I believe, the first of his publications. The next to adopt it were Messrs. Chambers and Mr. Bartholomew, who has done more than any other to make it known. After them it was adopted by Messrs. Nelson, Gall and Inglis, and Mr. Heywood, of Manchester.

Gall invites the free use of his projections, asking only that "when they are used, my name may be associated with them, and that they may be severally distinguished as Gall's stereographic, isographic, and orthographic projections of the world." Gall's (stereographic) projection was used, and credited to its originator, for the chart of winds and storms in Keith Johnston's series of atlases of physical geography; and it is described, with the statement that "this is the first published map in which this projection has been used", in the *Hand Book of Physical Geography* (Edinburgh and London, 1870) written to accompany these atlases, pages 162–163. The chart is here reproduced as figure 3.

The subsequent widespread dissemination of the projection through meteorological literature appears to have arisen from its adoption in several classic publications issued at Edinburgh, especially the monographs by Alexander Buchan. Buchan's famous *Handy Book of Meteorology* (Edinburgh and London; first edition 1867, second edition 1868) contains world charts of isobars and isotherms on the Mercator projection; but his *Introductory Text-Book of Meteorology* (Edinburgh and London, 1871) employs Gall's projection, though without designation and with no indication of the reasons for its adoption. Buchan also used this projection in his first study of the distribution of pressure and winds over the globe,[7] again without giving the name of the projection; and finally, he employed it in the great Challenger Report,[8] on page v of which occurs a statement that the report contains 52 newly constructed maps, of which "26 shew the mean monthly and annual temperature on hypsobathymetric maps, first on Gall's projection, and second on north circumpolar maps on equal surface projection; and 26 shew, for each month and for the year, the mean pressure of the atmosphere and the winds" also on Gall's projection.

Buchan's great work remains a classic and standard source of information even today. Previous to the Challenger expedition, available observations of the meteorological elements were almost entirely restricted to land; and the only comprehensive investigations on the distribution of the elements over the globe were those of Dove on temperature,[9] the previous memoir by Buchan on pressure and winds, and that of Coffin on winds,[10] all necessarily based on incomplete and more or less defective data. Buchan undertook a rediscussion of all the available information, with special reference to the Challenger observations. His revision of the world maps of pressure, temperature, and winds attained a degree of completeness and homogeneity not previously reached; and nothing comparable has since been achieved for the globe as a whole with the further data now available.[11]

Buchan edited the *Atlas of Meteorology* that forms Vol. III of Bartholomew's Physical Atlas, and the world maps in this atlas are on Gall's projection. The projection frequently appears in many modern atlases, particularly those by Bartholomew, but usually without a designation, though the other projections used are often labeled. Buchan's world meteorological charts have been widely copied; and thus the projection has found its way into numerous standard meteorological texts and reference books, e. g., Davis' Elementary Meteorology; Milham's Meteorology; Humphreys' Physics of the Air; and many other publications. The distributions of pressure and temperature over the world are to a marked extent latitudinal, hence an increase in the longitudinal scale of a map in high latitudes is not so important as a latitudinal effect; in this respect, Gall's projection is better than Mercator's, because the rapidly increasing scale of the latter in high latitudes leads to an excessive separation of the isotherms and isobars toward the poles.

[6] Rev. James Gall. Use of cylindrical projections for geographical, astronomical, and scientific purposes. Scottish Geographical Magazine, 1:119–123, 1885.

[7] Alexander Buchan: The mean pressure of the atmosphere and the prevailing winds over the globe, for the months and for the year. Pt. II. Trans. Roy. Soc. Edinb., 25:575–637, 1869. The charts were engraved by W. and A. K. Johnston. On p. 577 is the statement that the data were entered on polar and Mercator projections and then "ultimately transferred to charts of the projection on plates XXV to XXVII."

[8] Report on the scientific results of the voyage of H. M. S. *Challenger* during the years 1873–76. Physics and Chemistry, vol. II, pt. V. Report on atmospheric circulation. By Alexander Buchan. London, 1889. The charts were engraved by Bartholomew.

[9] H. W. Dove. Die Verbreitung der Wärme auf der Oberfläche der Erde, Berlin, 1852; English edition, London, 1853. Die Monats- und Jahres-Isothermen in der Polar-Projection, Berlin, 1864 (for the northern hemisphere).

[10] J. H. Coffin. Winds of the Globe. Smithsonian Institution, Cont. to Knowl., vol. XX, Washington, 1875.

[11] See Edgar W. Woolard. Historical note on charts of the distribution of temperature, pressure, and winds over the surface of the earth, MONTHLY WEATHER REVIEW, 48:408–411, 1920.

TROPICAL DISTURBANCES, SEPTEMBER 1936

By I. R. TANNEHILL

[Marine Division, Weather Bureau, Washington, October 1936]

Six tropical disturbances were charted during September in the North Atlantic Ocean and Gulf of Mexico, and three in the southeastern North Pacific Ocean near the coast of Mexico. Three of the six disturbances on the Atlantic side were of full hurricane intensity; one was of only moderate force; the other two were of minor character. Accounts of the Pacific disturbances are contained in this REVIEW under the heading "North Pacific Ocean."

August 28–September 5.—The first indications of this disturbance were contained in radio reports from ships in the vicinity of 15° N., 45° W. on August 28. According to a report received by mail, the S. S. *Van Rensselaer* at about 9 a. m. (ship's time) on that date at 16°14′ N., 43°14′ W., had wind WSW., 5, with barometer reading 29.67 inches (corrected); at 4 p. m. the highest wind, SSE. 10, was experienced on this ship at about 17½° N., 42° W.

After August 28, observations were lacking in the vicinity of the disturbance until the evening of August 31, when ship reports definitely placed the center of a vigorous cyclone near 25° N., 56° W. It is not possible with available reports to locate the center of the disturbance prior to August 31. However, observations at 7 a. m. (eastern standard time) on the 28th were received by radio from the S. S. *Robin Gray* at 10.3° N., 44.7° W., and from the S. S. *Western Queen* at 12.5° N., 46° W., also at 7 p. m. (eastern standard time) from the S. S. *Van Rensselaer*, which was then at 17.5° N., 41.3° W., wind SE. 5, with indications that a tropical storm had formed. This is the farthest area to the eastward in the Atlantic in which the existence of a tropical disturbance has been revealed by radio reports to the Weather Bureau. The previous record was the location of a disturbance on the morning

of September 10, 1928, by a radio report from the S. S. *Commack* in 17° N., 48°15′ W.[1]

By September 1 the disturbance had attained full hurricane intensity. The S. S. *Pan America* reported its lowest barometer reading, 29.01, at 1 p. m., ship's time, at 27°14′ N., 58°08′ W., with wind NW., force 11, increasing to NW. 12 at 2 p. m.

On September 2, the hurricane recurved to the eastward of Bermuda with center in longitude 58° W. Between 2 and 3 a. m., ship's time, on September 3, the S. S. *West Lashaway* at 35°22′ N., 54°14′ W., had full hurricane winds, ESE., barometer 28.71. Reports indicate that full hurricane intensity was maintained until the morning of the 5th near 42° N., 39° W., where the S. S. *Nike* experienced wind WSW., force 10, barometer 28.32.

September 7–8.—At 7 a. m. eastern standard time, September 7, the S. S. *Chesapeake* at 20°17′ N., 58°56′ W., with wind SW. by S., barometer 29.77 (uncorrected) reported that there were indications of a tropical disturbance forming to the northward. Other observations from the vicinity at that hour placed the center at about 21° N., 59° W. Twelve hours later there was a mild cyclonic wind circulation over the Leeward Islands and the ocean to the northward, with center near 21° N., 62° W. By the morning of the 8th, the disturbance, which continued to be of minor intensity, appeared to have advanced toward the west-northwestward, but later observations failed to reveal any definite wind circulation.

September 8–26.—While the preceding disturbance was dissipating near the Leeward Islands on the 8th, there were signs of another disturbance to the eastward with center in the vicinity of 13° N., 50° W., at 7 p. m., eastern standard time, of the 8th. At that time the S. S. *West Selene* was at 13.3° N., 52.1° W., and a long swell from the northeast was observed. The swell became heavier late on the 9th and on the 10th, with slowly falling barometer, when the vessel was about 250 miles east of the Leeward Islands. The observing officers estimated the distance to the disturbance to be about 100 miles.

Reports from other vessels on the 10th indicated the presence of a well-developed cyclone centered at approximately 18° N., 55° W. During the following week, it moved steadily northwestward and approached the North Carolina coast on the 17th. Its progressive movement was very slow at first but increased to about 10 miles an hour as it approached Hatteras.

By the morning of September 15 the hurricane was of wide extent and marked intensity. On the 16th the area of winds of force 6 and higher (Beaufort scale) was about 1,000 miles in diameter. By that criterion it was one of the largest tropical cyclones of record.

As the hurricane center approached Hatteras it began recurving to northward and, after passing a short distance east of the Virginia Capes on the 18th, it turned northeastward at an increasing progressive rate. The storm maintained its identity until the 26th at about 45° N., 30° W. The entire track is shown on chart XI.

A considerable number of ships were heavily involved in or very near the hurricane center. A digest of the wind and barometric observations of several of them is contained in the table of "Ocean gales and storms" elsewhere in the REVIEW. One in particular, the S. S. *El Occidente*, in 35°10′ N., 74°50′ W., at 5 a. m. (ship's time) of the 18th had lowest barometer 28.60 inches, and reported light fog during the lull at the center about 6 a. m.

In the vicinity of Hatteras, the hurricane was one of the most severe of record. The maximum wind velocity was 80 miles an hour from the northwest (corrected). A report from the official in charge of the Weather Bureau office at Hatteras includes the following:

> There was no loss of life on the entire island, but considerable damage to property: Homes, fishing equipment, wharves, fish houses, ice houses, and many other small buildings all along the water front on the sound shore. From the island of Ocracoke, 20 miles south of Hatteras, where damage was only light, on up the North Carolina coast to the Virginia line, it is estimated that approximately $20,000 damage was done. This damage could not be avoided, because timely warning was given to all. Everyone took extra precaution to safeguard their property so far as possible, but there was nothing else that could be done. It is simply impossible to even imagine just what would have been the results, even in the loss of life, had it not been for the timely warnings given the entire public.

The Section Director of the Weather Bureau at Raleigh estimated the storm damage in North Carolina to roads and bridges, $25,000; to homes, fishing equipment, wharves, and fish houses, $30,000.

At Cape Henry the full force of the hurricane winds was not recorded; the anemometer cups and spindle were carried away by the wind at 11:37 a. m. (eastern standard time) of the 18th; one cup had previously been blown away. The wind was estimated at 75 miles an hour.

Conditions in the Virginia coastal area are summarized in the following excerpt from the report of the official in charge of the Norfolk Weather Bureau office:

> The tropical hurricane that visited the Tidewater area on September 17, on its journey up the coast, can be characterized as the worst storm ever experienced in this section, and only the intensive system of warnings by the Weather Bureau, and the splendid cooperation of the general public, as well as municipal, State, and national forces, saved it from being a major catastrophe.
>
> Every available facility and means for warning the public was utilized, the radio, the newspapers, Coast Guard communication circuits, and municipal protective agencies, resulting in preparedness on such a scale as was never before witnessed here.
>
> That the results fully justified the extensive preparations is evidenced by the comparative slight property loss suffered, estimated at not more than $200,000 in the city proper, and not more than $500,000 in the Norfolk area, while only two fatalities occurred in this section. Those were caused indirectly by the storm; W. T. Butt, 59 years of age, resident of Princess Anne, dying as the result of injuries suffered when struck on the head by flying debris, and Udell George, Negro, 23 years of age, was drowned in the southern branch of the Elizabeth River in an effort to recover a rowboat blown adrift.

Moving northeastward from the Virginia Capes, the hurricane center continued at sea, but gales were felt along the coast. At Nantucket the lowest barometer reading was 29.27 inches at about 5 a. m. of the 19th with maximum wind velocity 45 miles (extreme 58) at 7:40 a. m., eastern standard time.

Timely advices and warnings were disseminated at frequent intervals from Jacksonville and Washington as conditions justified. Northeast storm warnings were ordered by the Washington forecaster at 10:30 p. m., eastern standard time, on September 16, for the coastal region from Beaufort, N. C., to the Virginia Capes. Northwest storm warnings were ordered by the Jacksonville forecaster for the North Carolina coast south of Beaufort at 2:45 a. m. of September 17. At 10 a. m. of the 17th, hurricane warnings were ordered north of Beaufort to Manteo; and at noon from Beaufort southward to Wilmington. At 3:30 p. m. northeast storm warnings were extended to Atlantic City. At 9:30 a. m. of the 18th, displays were changed to whole gale warnings north of Virginia Capes to Sandy Hook. Whole gale warnings were ordered at 4 p. m. from New Haven to Provincetown; and northeast storm warnings were displayed elsewhere north of Sandy Hook.

[1] MONTHLY WEATHER REVIEW, 1928, p. 347.

September 11–13.—Of only moderate intensity, this disturbance was first located by radio reports from the S. S. *Turpam* in 22° N., 93° W., at 1 p. m., eastern standard time, on the 11th, wind ESE., force 7, barometer 29.80, and indications that a tropical storm had formed. The S. S. *Nemaha*, at 26° N., 95° W., reported that the highest wind experienced was southeast, force 8, with lowest barometer 29.77 at 3 a. m. eastern standard time, September 13. Without evidence of increase in intensity, the disturbance moved in a general northwest direction and crossed the Texas coast near Brownsville on the 13th.

The report of Forecaster Dyke at New Orleans included the following:

The disturbance moved slowly northwestward until the evening of the 12th, when it turned to the right and moved rapidly north-northwestward, passing very close to and east of Brownsville, Tex., on the morning of the 13th, moving at the average rate of approximately 16 miles an hour from 7 a. m. of the 12th to 8 a. m. of the 13th. There was apparently little variation in intensity, as reported wind velocity and barometric pressure while the disturbance was over water and when it reached shore were about the same. Thereafter it passed inland to the west of Corpus Christi, Tex. Easterly winds of force 7 prevailed on Padre Island at Brazos Santiago Pass, 23 miles northeast of Brownsville; and westerly wind of 27 miles an hour was recorded at Brownsville at 7:48 a. m., eastern standard time, showing that the center of the disturbance, probably without a calm or lull, passed between Brownsville and Brazos Santiago Pass. A maximum wind velocity of 35 miles an hour was recorded at Corpus Christi at 12:30 p. m., eastern standard time. A wind of 30 miles an hour from the southeast occurred at Galveston before 8 a. m. The lowest pressure reported was 29.54 at Brownsville at 7 a. m., eastern standard time. Tide-gage readings on the Texas coast were not much above normal.

On indications of the 8 p. m. map of the 12th, northeast storm warnings were ordered from Brownsville to Corpus Christi. Previously in the afternoon a bulletin was sent to Galveston, Corpus Christi, and Brownsville, advising that persons on exposed islands and in boats off Texas coast from Matagorda Bay to Port Isabel should return to the mainland for the week end, due to possibility of storm increasing in intensity and curving so as to move farther north. Fortunately an increase in intensity did not occur and it became unnecessary to use United States Coast Guard planes which were sent to the Texas coast during the night but were not used for warning purposes. Persons who evacuated the islands and found shelter escaped the driving rains attending the storm.

Storm warnings were extended at night and morning of the 13th over the remainder of the Texas coast.

September 19–24.—Reports from the Leeward Islands and vessels to the northward gave some evidence of cyclone formation at about 21° N., 63½° W., at 7 a. m. of September 19. Somewhat more definite cyclonic circulation was apparently centered at about 24° N., 67½° W., at 7 a. m. of the 20th, with northwestward movement. During the 21st, very rapid development took place with recurve to the north-northeastward. As a fully developed hurricane of small diameter, it was centered close to 29° N., 70° W., at noon on the 22d.

The S. S. *Saramacca* passed through the center of the disturbance on the 22d at 28°55′ N., 69°45′ W., with lowest barometer 28.86 at noon, ship's time, and wind SSW., 12.

Near the point of recurve the hurricane moved slowly but its progressive speed increased on the 23d; and by 7 p. m. of the 24th it was approaching Nova Scotia. During the night it merged with another disturbance approaching from the westward.

September 25–October 1.—This disturbance appears to have been of minor character at all stages. Its beginnings are not clearly shown in the observations at hand. As a weak depression it moved west-northwestward across Florida on the 27th and early on the 28th, then northwestward across the extreme northeastern Gulf, and inland at Apalachicola. From the report of Forecaster Dunn at Jacksonville:

A maximum wind velocity of 26 miles from the south occurred at Tampa. * * * Tarpon Springs reported an estimated velocity of 35 miles. This storm did not give any strong winds at Apalachicola although a barometer reading of about 29.70 inches occurred early on the 29th. Except for notice of squalls in the East Gulf marine forecast, no warnings were issued in connection with this disturbance.

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By AMY D. PUTNAM

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SOLAR OBSERVATIONS

SOLAR RADIATION OBSERVATIONS DURING SEPTEMBER 1936

By IRVING F. HAND, Assistant in Solar Radiation Investigations

For a description of instruments employed and their exposures, the reader is referred to the January 1935 REVIEW, page 24.

Table 1 shows that solar radiation intensities averaged slightly below normal for September at both Washington and Madison, and close to normal at Lincoln.

Table 2 shows a deficiency in the total solar and sky radiation received on a horizontal surface at Madison, Lincoln, Chicago, Twin Falls, Miami, and New Orleans, and an excess at all other stations.

Polarization observations taken at Washington on 6 days give a mean of 55 percent with a maximum of 64 percent on the 25th. At Madison, observations on 6 days give a mean of 62 percent with a maximum of 69 percent on the 24th. These values are close to the September normals.

TABLE 1.—*Solar radiation intensities during September 1936*

[Gram-calories per minute per square centimeter of normal surface]

WASHINGTON, D. C.

Date	Sun's zenith distance										
	8 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e
	mm	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm*
Sept. 1	10.21	0.50	0.60	0.76	0.98	------	------	------	------	------	10.21
Sept. 4	10.21	------	------	.60	.80	------	------	------	------	------	11.81
Sept. 5	11.38	------	------	.75	.92	------	------	------	------	------	10.97
Sept. 8	14.10	.58	.70	.83	1.02	1.29	------	------	------	------	11.76
Sept. 16	14.10	------	.64	.78	.98	------	------	------	------	------	14.60
Sept. 22	16.20	------	------	.64	.85	------	------	------	------	------	13.13
Sept. 23	16.20	------	.19	.54	.69	------	------	------	------	------	13.61
Sept. 25	5.56	------	1.06	1.19	1.35	1.50	1.30	1.20	1.10	1.05	5.36
Sept. 26	7.04	------	------	------	1.00	------	------	------	------	------	8.18
Means	------	(.54)	.64	.76	.95	(1.40)	(1.30)	(1.20)	(1.10)	(1.05)	------
Departures	------	−.15	−.11	−.10	−.09	------	+.23	+.33	+.35	+.36	------

[1] Extrapolated.

TABLE 1.—*Solar radiation intensities during September 1936*—Con.

MADISON, WIS.

Date	Sun's zenith distance										
	8 a. m.	78.7°	75.7°	70.7°	60.0°	0.0°	60.0°	70.7°	75.7°	78.7°	Noon
	75th mer. time	Air mass									Local mean solar time
		A. M.					P. M.				
	e	5.0	4.0	3.0	2.0	[1] 1.0	2.0	3.0	4.0	5.0	e
	mm	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*mm*
Sept. 4	10.59	------	------	.91	------	------	------	------	------	------	13.13
Sept. 8	13.61	------	.91	1.08	------	------	------	------	------	------	13.61
Sept. 17	6.02	------	------	------	------	1.46	------	------	------	------	6.50
Sept. 18	7.87	------	.79	.98	1.15	------	------	------	------	------	8.48
Sept. 21	8.81	------	.91	1.15	1.28	1.56	------	1.14	------	------	10.59
Sept. 22	12.24	------	------	------	------	------	1.17	------	------	------	17.37
Sept. 23	14.60	.62	.76	.90	1.09	------	------	------	------	------	17.37
Sept. 24	5.79	1.03	1.08	1.22	1.37	1.56	------	------	------	------	6.27
Sept. 25	6.50	.73	.81	.96	1.14	------	1.05	------	------	------	8.48
Means	------	.80	.88	1.03	1.21	1.53	(1.11)	(1.14)	------	------	------
Departures	------	−.04	−.03	.00	+.05	------	−.07	+.11	------	------	------

LINCOLN, NEBR.

Sept. 5	18.59	0.78	0.90	1.02	1.21	1.40	------	------	------	------	19.23
Sept. 9	13.61	.90	.98	1.11	1.26	1.49	1.25	1.10	0.96	0.84	13.13
Sept. 14	13.61	------	.92	1.08	1.23	------	------	------	------	------	15.11
Sept. 16	8.81	------	------	------	------	------	------	1.11	.98	.89	6.02
Sept. 17	6.76	------	1.02	1.15	1.35	1.55	1.28	1.05	.87	.76	5.16
Sept. 21	9.83	.83	.93	1.08	1.26	------	1.22	1.05	.90	.72	9.83
Sept. 22	12.24	.86	.96	1.10	1.26	------	------	------	------	------	13.13
Sept. 23	15.65	------	------	------	------	------	1.07	.80	.54	.41	6.27
Sept. 24	5.16	.84	.93	1.06	1.27	------	1.15	.93	.75	.63	4.95
Sept. 30	7.04	------	------	------	------	------	1.28	.75	.55	.49	8.81
Means	------	.85	.95	1.09	1.26	1.48	1.21	.97	.79	.68	------
Departures	------	+.11	+.11	+.12	+.13	------	+.05	−.01	−.05	−.05	------

BLUE HILL, MASS.

Sept. 1	8.2	------	------	1.10	1.18	1.28	1.02	0.88	0.77	0.62	6.8
Sept. 2	7.9	------	------	------	.98	------	------	------	------	------	10.3
Sept. 4	10.3	------	------	------	------	1.24	1.12	------	------	------	10.3
Sept. 6	10.7	0.82	0.91	1.01	1.17	1.28	------	------	------	------	11.1
Sept. 7	11.5	------	.48	.88	.76	------	------	------	------	------	12.8
Sept. 8	15.8	------	------	------	.96	1.10	------	------	------	------	17.5
Sept. 9	15.3	------	------	.67	.86	1.25	------	------	------	------	16.4
Sept. 11	11.9	------	------	------	------	1.21	.93	.73	------	------	13.7
Sept. 14	7.1	------	------	1.05	1.22	1.40	------	------	------	------	6.1
Sept. 16	12.3	------	------	------	------	1.16	.86	------	------	------	14.3
Sept. 17	14.7	------	------	.60	------	------	------	------	------	------	14.7
Sept. 19	9.6	------	------	1.08	1.25	1.44	------	------	------	------	8.8
Sept. 22	13.7	------	------	------	------	------	.91	------	------	------	11.5
Sept. 23	13.7	------	------	------	------	1.17	1.05	.92	.78	------	14.3
Sept. 24	14.3	------	------	------	------	1.35	------	------	------	------	15.3
Sept. 25	5.6	------	1.09	1.23	1.35	1.49	1.32	------	------	------	5.2
Sept. 26	6.1	------	.93	1.10	1.16	1.24	1.19	------	------	------	7.4
Sept. 28	11.1	------	------	------	------	1.44	1.18	------	------	------	5.1
Sept. 29	4.2	------	------	1.08	1.25	1.36	------	------	------	------	6.3
Means	------	.82	.85	.95	1.10	1.29	1.06	.84	.76	.62	------

TABLE 2.—*Average daily totals of solar radiation (direct + diffuse) received on a horizontal surface*

Week beginning—	Gram-calories per square centimeter															
	Washington	Madison	Lincoln	Chicago	New York	Fresno	Fairbanks	Twin Falls	La Jolla	Miami	New Orleans	Riverside	Blue Hill	San Juan	Friday Harbor	Ithaca
1936	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*	*cal.*
Sept. 3	556	351	465	386	427	591	170	436	502	468	355	497	480	490	495	410
Sept. 10	371	202	378	288	330	590	271	424	514	406	318	479	316	560	361	322
Sept. 17	448	307	482	387	229	530	180	437	390	393	402	424	286	457	310	469
Sept. 24	293	263	297	222	274	478	140	402	390	319	307	445	406	454	357	265
Departures from weekly normals																
Sept. 3	+173	−23	+6	+48	+113	+21	−17	−39	.....	+31	−68	+3	+120	.....	+84	+62
Sept. 10	+5	−133	−49	−6	+17	+45	+56	−30	.....	−18	−8	+17	−27	.....	+1	−30
Sept. 17	+82	+53	+61	−84	−70	+36	+33	+25	.....	−40	+94	−11	−46	.....	−39	+127
Sept. 24	−59	−29	−77	+9	−4	+13	+17	−29	.....	−88	−42	+32	+73	.....	+13	−27
Accumulated departures on Sept. 30																
	+5,593	+2,422	+7,042	+10,766	+7,021	+5,089	+4,151	−1,806	.....	7,819	.....	−21	−434	.....	+553	+1,743

TABLE 3.—*Total, I_m, and screened, I_y, I_r, solar radiation intensity measurements, obtained during September 1936 and determinations of the atmospheric turbidity factor, β, and water-vapor content, w=depth in millimeters, if precipitated*

AMERICAN UNIVERSITY, WASHINGTON, D. C.

Date and hour angle	Solar altitude	Air mass	I_m	I_y	I_r	$\beta_{I_{m,r}}$	$\beta_{I_{y,r}}$	$\beta_{m,\lambda=0.5}$	$\frac{I_{w,r}}{1.94}$ Percentage of solar constant	$\frac{I_{w,r}-I_m}{1.94}$ Percentage of solar constant	w	Air-mass type
1936												
Sept. 1	° ′	*m*	*gr. cal.*	*gr. cal.*	*gr. cal.*						*mm*	
1:12 a. m.	55 18	1.21	1.091	0.779	0.620	0.158	0.142	0.150	68.4	11.1	25.0	NPc
1:07 a. m.	54 49	1.22	1.086	.779	.620	.160	.138	.149	68.4	11.4	25.8	
Sept. 8												
3:10 a. m.	35 59	1.70	1.066	.770	.616	.110	.096	.103	66.6	11.1	13.0	NPc→TM
3:06 a. m.	36 41	1.67	1.057	.770	.616	.120	.098	.109	66.6	11.5	13.6	
Sept. 25												
4:11 a. m.	20 14	2.88	1.200	.880	.720	.040	.038	.039	67.8	5.9	1.8	NPc
4:06 a. m.	21 09	2.76	1.209	.880	.720	.042	.040	.041	67.6	4.1	1.0	
3:34 a. m.	26 55	2.20	1.306	.966	.783	.056	.028	.042	73.7	6.3	2.2	
3:31 a. m.	27 37	2.13	1.320	.960	.783	.053	.031	.042	73.9	5.8	2.1	
3:13 p. m.	30 40	1.95	1.312	.953	.748	.046	.010	.028	67.7	8.6	4.2	
3:18 p. m.	30 06	1.99	1.297	.953	.748	.054	.010	.027	66.9	9.4	4.8	

POSITIONS AND ARBAS OF SUN SPOTS

[Communicated by Capt. J. F. Hellweg, U. S. Navy (Ret.), Superintendent U. S. Naval Observatory. Data furnished by the U. S. Naval Observatory in cooperation with Harvard and Mount Wilson Observatories. The difference in longitude is measured from the central meridian, positive west. The north latitude is positive. Areas are corrected for foreshortening and are expressed in millionths of the sun's visible hemisphere. The total area for each day includes spots and groups]

Date	Eastern standard time	Heliographic			Area		Total area for each day	Observatory
		Diff. in longitude	Longitude	Latitude	Spot	Group		
1936	h. m.	°	°	°				
Sept. 1	11 20	−72.0	320.0	−17.0	15	.....	.....	U. S. Naval.
		−59.0	333.0	+14.0	.....	31	.....	
		+24.0	56.0	−27.5	.....	432	.....	
		+42.5	74.5	−22.0	15	.....	.....	
		+62.0	94.0	−11.0	.....	39	.....	
		+77.0	109.0	−17.0	15	.....	.....	
		+78.0	110.0	−25.5	.....	15	562	
Sept. 2	12 25	−70.0	308.2	+28.0	9	.....	.....	Mt. Wilson.
		−65.0	313.2	−19.0	.....	54	.....	
		−45.0	333.2	+14.0	32	.....	.....	
		+38.0	56.2	−26.0	.....	356	.....	
		+58.0	76.2	−21.5	11	.....	.....	
		+72.0	90.2	−9.0	.....	20	482	
Sept. 4	11 40	−45.5	306.7	−19.0	.....	123	.....	U. S. Naval.
		+21.5	13.7	−16.0	.....	93	.....	
		+62.0	54.2	−27.0	.....	370	586	
Sept. 5	11 12	−43.0	296.3	−18.0	.....	31	.....	Do.
		−32.0	307.3	−19.0	.....	216	.....	
		−18.0	321.3	+9.0	.....	93	.....	
		+35.0	14.3	−17.0	.....	31	.....	
		+76.0	55.3	−27.0	.....	216	587	
Sept. 6	13 10	−18.0	307.0	−19.0	.....	247	.....	Do.
		−2.0	323.0	+9.0	.....	216	463	
Sept. 7	10 50	−3.0	310.1	−18.5	.....	123	.....	Do.
		+10.0	323.1	+9.0	.....	154	277	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Heliographic			Area		Total area for each day	Observatory
		Diff. in longitude	Longitude	Latitude	Spot	Group		
1936	h. m.	°	°	°				
Sept. 8	11 7	+11.0	310.7	−18.0	.....	108	.....	U. S. Naval.
		+24.0	323.7	+9.0	.....	123	231	
Sept. 9	11 4	+13.5	300.0	−18.5	.....	123	.....	Do.
		+25.0	311.5	−18.5	.....	123	.....	
		+39.0	325.5	+9.0	.....	278	524	
Sept. 10	15 21	−59.0	212.0	+24.0	15	.....	.....	Do.
		+29.5	300.5	−18.5	.....	247	.....	
		+40.0	311.0	−19.0	.....	154	.....	
		+55.0	326.0	+9.0	.....	370	786	
Sept. 11	13 11	−70.0	188.9	−19.5	62	.....	.....	Do.
		+42.0	300.9	−16.0	.....	340	.....	
		+52.0	310.9	−18.0	93	.....	.....	
		+68.0	326.9	+9.0	.....	278	773	
Sept. 12	12 9	−77.0	169.3	+16.0	8	.....	.....	Do.
		−68.0	178.3	+14.5	.....	154	.....	
		−58.0	188.3	−19.5	.....	123	.....	
		−42.0	204.3	+24.0	.....	93	.....	
		+55.0	301.3	−15.5	.....	494	.....	
		+66.0	312.3	−17.0	93	.....	.....	
		+81.0	327.3	+9.5	.....	154	1,119	
Sept. 13	12 0	−55.0	178.2	+16.0	.....	135	.....	Mt. Wilson.
		−41.0	192.2	−19.0	.....	105	.....	
		−29.0	204.2	+16.0	.....	5	.....	
		−28.0	205.2	+24.0	.....	9	.....	
		+17.0	250.2	−30.0	.....	127	.....	
		+48.0	281.2	+12.0	.....	9	.....	
		+68.0	301.2	+14.0	.....	7	.....	
		+70.0	303.2	−15.0	.....	571	.....	
		+80.0	313.2	−16.0	55	.....	.....	
		+88.0	321.2	+18.0	.....	33	1,056	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Heliographic			Area		Total area for each day	Observatory
		Diff. in longitude	Longitude	Latitude	Spot	Group		
1936	h. m.	°	°	°				
Sept. 14	11 2	−74.0	146.5	−19.5		93		U. S. Naval.
		−42.0	178.5	+15.5		154		
		−29.5	191.0	−19.5		62		
		+29.0	249.5	−30.5		340		
		+84.0	304.5	−16.0		247	896	
Sept. 15	11 25	−58.0	149.0	−20.0		234		Mt. Wilson.
		−27.0	180.0	+15.0		205		
		−14.0	193.0	−18.5		35		
		−2.0	205.0	+18.0		4		
		+42.0	249.0	−30.0		382	860	
Sept. 16	11 28	−60.5	133.4	−19.0	15			U. S. Naval.
		−45.0	148.9	−19.5		185		
		−15.0	178.9	+15.5		216		
		+55.0	248.9	−30.5		123	539	
Sept. 17	11 11	−30.0	150.8	−20.0		93		Do.
		−1.0	179.8	+15.5		154		
		+69.0	249.8	−30.5		93	340	
Sept. 18	9 50	−75.0	92.4	−24.0		110		Mt. Wilson.
		−60.0	107.8	+20.0		27		
		−33.0	134.8	−20.0	5			
		−16.0	151.8	−20.0		24		
		+14.0	181.8	+15.0		36		
		+25.0	192.8	−19.0		2		
		+80.0	247.8	−30.0		180	384	
Sept. 19	11 2	−60.0	94.5	−24.5		401		U. S. Naval.
		−49.0	105.5	+20.0		23		
		−44.5	110.0	+16.0		62		
		−20.0	134.5	−21.0		46		
		−8.5	146.0	−21.0	8			
		+1.0	155.5	−18.0	15		555	
Sept. 20	9 45	−59.0	83.0	−24.0		4		Mt. Wilson.
		−58.0	84.0	+29.0		4		
		−47.0	95.0	−23.0		124		
		−32.0	110.0	+20.0		47		
		−7.0	135.0	−21.0		25		
		+10.0	152.0	−18.0		16		
		+36.0	178.0	+15.0	5			
		+46.0	188.0	−12.0		27		
		+54.0	196.0	+16.0	4		251	
Sept. 21	11 3	−70.0	58.1	−24.0		62		U. S. Naval.
		−49.0	79.1	−24.0		123		
		−33.0	95.1	−23.5		370		
		−21.0	107.1	+20.0	8			
		−15.0	113.1	+18.0	23			
		+5.0	133.1	−20.5		340		
		+61.0	189.1	−13.0		93	1,019	
Sept. 22	11 21	−67.0	47.7	+14.0		31		Do.
		−63.0	51.7	+24.0	8			
		−55.0	59.7	−25.0		247		
		−35.0	79.7	−25.0		123		
		−21.0	93.7	−24.0		216		
		+18.0	132.7	−20.5		401	1,026	
Sept. 23	13 41	−55.0	45.3	+15.0		31		Do.
		−48.0	52.3	+14.0		31		
		−47.0	53.3	−24.0		31		
		−40.0	60.3	−25.0	247			
		−21.0	79.3	−25.0		154		
		−8.0	92.3	−24.0		93		
		+34.0	134.3	−21.0		216	803	
Sept. 24	9 45	−78.0	11.2	+12.0		33		Mt. Wilson.
		−45.0	44.2	+15.0	10			
		−33.0	56.2	+14.0		26		
		−28.0	61.2	−26.0		301		
		−23.0	66.2	−22.0		17		
		−7.0	82.2	−23.0		110		
		−1.0	88.2	−17.0		77		
		+7.0	96.2	−23.0		96		
		+8.0	97.2	+32.0	4			
		+20.0	109.2	+20.0		4		
		+47.0	136.2	−20.0		253	931	
Sept. 25	11 6	−63.0	12.3	+14.0		15		U. S. Naval.
		−16.0	59.3	−26.0		247		
		+1.0	76.3	−25.0		46		
		+9.0	84.3	−25.0		185		
		+12.0	87.3	−17.5		62		
		+63.0	138.3	−21.0		77	632	
Sept. 26	11 12	−49.0	13.0	+14.0	23			Do.
		−3.0	59.0	−25.0		278		
		+15.0	77.0	−24.0		31		
		+21.0	83.0	−25.0		93		
		+26.0	88.0	−17.5	31		456	

POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Heliographic			Area		Total area for each day	Observatory
		Diff. in longitude	Longitude	Latitude	Spot	Group		
1936	h. m.	°	°	°				
Sept. 27	9 45	−80.0	329.6	+17.0		589		Mt. Wilson.
		−78.0	331.6	+7.0	190			
		−39.0	10.6	+15.0		64		
		−11.0	38.6	+15.0		81		
		+10.0	59.6	−23.0		329		
		+18.0	67.6	+22.0		5		
		+31.0	80.6	−24.0		29		
		+38.0	87.6	−17.0		19		
		+40.0	89.6	−22.0	2			
		+77.0	126.6	+21.0		37	1,345	
Sept. 28	13 17	−68.0	326.5	+17.0		556		U. S. Naval.
		−64.0	330.5	+6.0		93		
		−25.0	9.5	+14.0		46		
		+3.0	37.5	+14.0		93		
		+23.0	57.5	−25.0		278		
		+41.0	75.5	−26.0		46	1,112	
Sept. 29	12 45	−80.0	301.6	+18.0		58		Mt. Wilson.
		−54.0	327.6	+18.0		633		
		−54.0	327.6	−20.0		34		
		−50.0	331.6	+7.0		82		
		−10.0	11.6	+15.0		50		
		−2.0	19.6	+16.0	8			
		+17.0	38.6	+15.0		59		
		+19.0	40.6	−28.0		7		
		+38.0	59.6	−24.0		258		
		+57.0	78.6	−25.0		31	1,220	
Sept. 30	12 30	−73.0	295.5	+19.0		286		Do.
		−68.0	300.5	−13.0	11			
		−41.0	327.5	+18.0		608		
		−40.0	328.5	−20.0		73		
		−38.0	330.5	+7.0		52		
		+3.0	11.5	+16.0		32		
		+11.0	19.5	+16.0		11		
		+30.0	38.5	+15.0		28		
		+31.0	39.5	−19.0		32		
		+50.5	59.0	−24.0		171		
		+57.0	65.5	+21.0	4			
		+72.0	80.5	−25.0		5	1,313	

Mean daily area for 29 days, 729.

PROVISIONAL SUN-SPOT RELATIVE NUMBERS, SEPTEMBER 1936

[Data dependent alone on observations at Zurich and its station at Arosa]

[Furnished through the courtesy of Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

September 1936	Relative numbers	September 1936	Relative numbers	September 1936	Relative numbers
1	*Ec* 110	11	*d* 49	21	*Eacd* 80
2	68	12	*Ec* 70	22	116
3	77	13	*Wc* 94	23	*a* 128
4	57	14	*d* 77	24	*a* 86
5	*Mc* 68	15	64	25	*Eac* 85
6	*a* 65	16	71	26	*Mac* 85
7	46	17	*a* 63	27	*d* --
8	*a* 53	18	*Ecd* 66	28	*a* 94
9	42	19	*Ec* 58	29	86
10	40	20	74	30	*ad* 106

Mean, 29 days=75.1.

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, in the central circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE in charge]

By L. P. HARRISON

Mean free-air temperatures and relative humidities for September, as determined from airplane weather observations, are given in table 1. The "departures from normal" given in the table are based on "normals" derived from the number of observations indicated in the note at the foot of the table, where the number of years over which the observations were taken are given by the figures in parentheses. In general, the numbers of observations available for computing "normals" for the higher levels are less than those available for the lowest levels (represented by the data given in the footnote). To compensate for this discrepancy, the "normals" are computed by the method of differences.

The mean temperatures for the month at the surface were slightly above normal over most of the country with the exception of northern and coastal New England, and New Mexico, western Texas, and parts of Utah, Arizona, Wyoming, Montana, Washington, and Oregon, where they were slightly below normal. The largest positive departures at the surface were generally to be found in the Mississippi Valley, especially in the south-central part of the country, where departures from +2° to +3° C were the rule. (See chart I.)

The departures from mean free-air temperatures for the month indicate that this above-normal thermal condition persisted markedly up to at least 5 km above sea level over a considerable area, particularly in the central Mississippi Valley region. On the other hand, Fargo, N. Dak., in the extreme north-central part of the country, had significant (>1° C.) positive departures of temperature from normal only up to the 2.5 km level, above which the monthly means were very near normal but still positive at least up to 5 km; whereas Billings, Mont., to the west, had positive departures of nearly 1° C. up to 5 km. Mitchel Field (L. I.), N. Y., and Lakehurst, N. J., on the east coast, had only insignificant departures from normal up to 1 km, but had positive departures of slightly more than 1° C., above that level at least up to 4 or 5 km. San Diego, Calif., had departures between +1° and +2° C. at 1 and 1.5 km, but insignificant departures at the remaining levels for which data are available.

The departures from "normal" of relative humidities near the surface were largely of negative sign in the central part of the country (maximum −7 percent at Oklahoma City), whereas the departures along the coastal regions were largely of positive sign (maximum +8 percent at Norfolk, Va., and Washington, D. C.). The data for Washington, D. C., show a remarkably large average fall in humidity from the surface to 500 m, viz, 87 percent (+8 percent departure), to 59 percent (−9 percent departure).

The departures from "normal" of the mean free-air relative humidities for the month indicate that, except near the surface, the region which had above-normal temperatures in the central part of the country likewise had above-normal relative humidities with departures ranging from +4 percent to as high as +14 percent. The greatest positive departures were to be found in the extreme south-central portion of the country, especially in the layer from about 2.5 to 5 km above sea level, as exemplified by the data for Oklahoma City, Okla., and Kelly Field (San Antonio), Tex. (+14 and +9 percent, respectively, at 5 km). By comparing the mean monthly relative humidities for El Paso, Tex., with those for neighboring stations, one is led to infer that the values for that place in the stratum from about 2 to 5 km were appreciably above normal (e. g., at 3 km we have El Paso, 70 percent; San Diego, 31 percent; Kelly Field, 61 percent; Salt Lake City, 40 percent; Cheyenne, 47 percent; Oklahoma City, 62 percent). (This inference is consistent with the above-normal precipitation which occurred in Texas and New Mexico in September.) In view of the distribution of positive departures, it may be stated that a "ridge" of relatively high humidity, extending in a southwest-northeast direction from about western Texas or New Mexico to about central Ohio, existed on the average during the month in the stratum from 2 to 5 km above sea level. In contrast to this "ridge", there is evidence that two "troughs" of relatively low humidity likewise existed on the average, running in approximately the same direction, one from the California coast to the Dakotas, and the other from the New England coast to about northern Alabama. These were most pronounced in the strata from 1 to 3 or more km above sea level, and 4 to 5 km, respectively. However, the negative departures were not on the whole as great in absolute value as the positive departures referred to above (e. g., at 2 km, Fargo, −5 percent; Cheyenne, −3 percent; and at 5 km, Lakehurst, −9 percent; Washington, −9 percent; Murfreesboro, −6 percent). The data for 5 km at Omaha, Nebr., and Selfridge Field (Mount Clemens, near Detroit), Mich., indicate that humidities were relatively low in general by small amounts over a good portion of the northeast sector of the country. At San Diego, on the southwest coast, the above-normal humidities in the surface layer (+5 percent) gave way to subnormal humidities up to approximately 2.5 km (maximum departure −8 percent at 1.5 km), above which super-normal humidities again appeared on the average (maximum departure +5 percent at 5 km). At Oakland, the relative humidities for the month fell off rapidly with elevation in the first kilometer from 82 to 33 percent, and then fell more slowly, until at 5 km the mean value was but 19 percent as compared with 30 percent for San Diego, 36 percent for Seattle, 48 percent for Spokane, and 43 percent for Salt Lake City. In the north-central part of the country, Fargo exhibited relative humidities which were 2 to 5 percent below normal in the layer from the surface to 3 km, but 2 to 4 percent above normal in the layer from about 4 to 5 km. The mean relative humidities for Sault Ste. Marie during September were somewhat outstanding in the lower 3 km by appearing relatively high as compared with nearby stations.

The free-air resultant winds based on pilot balloon observations made during the month of September are given in table 2. In general, the directions of the resultant winds for the month did not depart greatly from normal except in a relatively few instances. In particular, stations along the Pacific coast exhibited the largest departures in this respect. At Seattle, for the level 500 m, the monthly resultant was 360°, 2.4 m. p. s., and the normal 236°, 0.7 m. p. s. For the 1 and 1.5 km levels, the orientations of the monthly resultants were 60° and 27°, respectively, clockwise with respect to the normal, hence more northerly. At Medford, the following contrasts existed between monthly resultants and normals (in paren-

theses), respectively: 2 km, 60°, 1.2 m. p. s. (151°, 0.3 m. p. s.); 3 km, 328°, 1.7 m. p. s. (254°, 2.9 m. p. s.); 4 km, 319°, 2.4 m. p. s. (276°, 3.7 m. p. s.). At Oakland, in the lowest 500 m, the monthly resultant is oriented about 20° clockwise of the normal, while from 2 to 3 km, it is oriented approximately 20° to 40° counterclockwise of the normal. San Diego and Atlanta, Ga., likewise show differences in resultant direction from normal but inasmuch as the resultant velocities were relatively small, the differences are not very significant.

The resultant velocities were generally slightly greater than normal in the southern Mississippi Valley (maximum departure at Oklahoma City, 1 km, resultant 208°, 13.7 m. p. s., normal 209°, 8.9 m. p. s.) and largely lower than normal by slight amounts at practically all levels in an east-west strip through the center of the country. In the Northern States, the resultant velocities were generally somewhat greater than normal (maximum departure Sault Ste. Marie, at 3 km, resultant 303°, 14.6 m. p. p. s.; normal 285°, 9.3 m. p. s.) except in New England where they were generally less than normal by small amounts.

At the 2.5 and 3 km levels, the monthly resultants indicated a small anticyclonic circulation over the extreme southern Mississippi Valley. The greater than normal resultant velocity toward the west side of the valley brought about somewhat greater than normal transport of moisture-laden air northward up the valley from the Gulf and then eastward. On the other hand, the trajectory of some of the moist air was from the Gulf over Mexico and Texas to New Mexico and even Arizona whence it was deflected northward and eastward. To the northwest on the contrary, the trajectory of the Polar Pacific and also Polar Continental air not infrequently coming down over the Plateau and North Pacific States was to the southward, southeastward, and then eastward. The consequence of the trajectories of these contrasting air masses was an interaction which took place over a frontal zone extending roughly southwest to northeast, with the line from Arizona to Michigan forming the western limit of the zone. These conditions were conducive of above-normal precipitation over most of the States between that line and one running from east Texas to Ohio (percentages of normal precipitation for September 1936, according to Weekly Weather and Crop Bulletin, October 7, 1936; Texas, 250 percent; New Mexico, 173 percent; Oklahoma, 253 percent; Kansas, 172 percent; Missouri, 209 percent; Iowa, 211 percent; Illinois, 183 percent. Precipitation was deficient in the extreme West, Northwest, Northeast, and Southeast).

The subsidence in the Polar Pacific (P_p), Polar Continental (P_c), and dry Superior air (S) coming over the Pacific coast and the Northwestern States doubtless was contributory to the low humidities observed in that general region at moderate and high levels, as well as to the subnormal precipitation which occurred there.

The frequent invasions of Polar Continental and modified Polar Pacific air masses over the northeastern sector of the country was the basic cause for the deficient precipitation in that area.

TABLE 1.—*Mean free-air temperatures and relative humidities obtained by airplanes during September 1936*

TEMPERATURE (° C.)

Stations	Altitude (meters) m. s. l.																Number of observations
	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	
Barksdale Field (Shreveport), La.[1] (52 m)	23.0	------	23.8	------	21.6	------	18.9	------	15.8	------	13.0	------	10.5	------	4.6	------	−1.1	------	27
Billings, Mont.[2] (1,088 m)	12.3	+0.7	------	------	------	------	14.7	+0.9	12.3	+0.9	8.9	+0.6	5.6	+0.7	−0.9	+0.8	−6.8	+1.1	30
Boston, Mass.[1] (5 m)	15.3	------	14.4	------	12.9	------	10.7	------	8.4	------	6.6	------	4.7	------	−0.5	------	−5.8	------	26
Cheyenne, Wyo.[2] (1,873 m)	9.4	+1.1	------	------	------	------	------	------	11.2	+0.6	11.5	+0.2	8.7	+0.3	1.9	+0.3	−4.8	+0.7	30
El Paso, Tex.[2] (1,194 m)	19.3	------	------	------	------	------	20.2	------	18.1	------	15.0	------	12.1	------	5.1	------	−1.3	------	30
Fargo, N. Dak.[2] (274 m)	13.5	+3.1	16.3	+2.8	14.4	+2.1	12.3	+2.0	9.6	+1.6	6.8	+1.3	3.2	+0.7	−2.9	+0.4	−8.4	+0.6	28
Kelly Field (San Antonio), Tex.[1] (206 m)	22.3	+0.8	22.4	+0.3	20.7	+0.3	18.4	+0.4	15.9	+0.5	13.4	+0.4	11.1	+0.7	5.1	+0.5	−1.0	+0.8	29
Lakehurst, N. J.[3] (39 m)	16.2	+1.4	17.1	+1.1	15.1	+1.4	13.6	+1.4	11.7	+1.3	9.7	+1.1	7.5	+1.1	3.3	+1.4	−1.2	+1.8	21
Maxwell Field (Montgomery), Ala.[1] (52 m)	21.9	+1.7	23.3	+1.0	21.2	+1.2	18.0	+0.8	15.6	+0.7	13.0	+0.7	10.2	+0.7	4.5	+1.0	−0.9	+1.7	29
Miami, Fla.[2] (4 m)	23.9	------	24.6	------	21.6	------	18.6	------	15.8	------	13.2	------	10.5	------	5.1	------	−0.9	------	29
Mitchel Field (Hempstead, L. I.), N. Y.[1] (29 m)	15.3	0.0	15.7	−0.1	13.7	−0.2	12.4	+0.1	10.5	+0.3	9.0	+0.7	6.8	+1.1	1.9	+1.4	------	------	20
Murfreesboro, Tenn.[2] (174 m)	20.6	+2.5	22.4	+1.8	20.6	+1.8	17.6	+1.7	14.4	+1.2	11.6	+1.2	8.9	+1.2	3.1	+1.4	−2.5	+2.0	29
Norfolk, Va.[3] (10 m)	20.5	−1.3	20.4	−0.4	17.4	−0.9	14.7	−1.0	12.6	−0.6	10.4	−0.2	7.9	−0.1	2.3	−0.1	−3.1	+0.2	18
Oakland, Calif.[2] (2 m)	13.8	------	20.9	------	21.9	------	19.1	------	15.8	------	12.6	------	9.8	------	3.2	------	−3.0	------	30
Oklahoma City, Okla.[2] (391 m)	22.7	+4.1	23.3	+3.9	22.3	+3.0	19.7	+2.5	16.8	+1.9	13.7	+1.6	10.7	+1.6	4.5	+1.8	−1.3	+2.2	27
Omaha, Nebr.[2] (300 m)	17.8	+2.3	19.3	+2.2	19.3	+0.9	17.1	+0.5	14.6	+0.4	11.7	+0.4	8.7	+0.4	2.5	+0.6	−3.9	+0.8	30
Pensacola, Fla.[3] (13 m)	23.0	−0.2	23.6	+1.2	20.5	+0.7	17.4	+0.2	14.8	+0.4	12.5	+0.7	9.8	+0.9	4.1	+0.9	−1.3	+1.0	30
Salt Lake City, Utah[2] (1,288 m)	10.8	------	------	------	------	------	16.1	------	15.5	------	12.0	------	8.1	------	1.2	------	−6.0	------	30
San Diego, Calif.[3] (10 m)	18.5	−0.4	17.9	+0.6	21.3	+1.4	20.7	+1.7	17.6	+0.3	14.7	+0.3	11.3	+0.1	4.9	+0.2	−2.0	−0.5	30
Sault Ste. Marie, Mich.[2] (221 m)	11.6	------	12.0	------	10.6	------	8.4	------	6.0	------	4.0	------	1.4	------	−3.8	------	−9.0	------	30
Scott Field (Belleville), Ill.[1] (135 m)	19.1	+3.4	21.8	+2.1	20.5	+2.3	18.2	+2.5	15.3	+2.2	12.2	+2.0	9.3	+2.0	3.1	+2.1	−2.5	+2.8	22
Seattle, Wash.[2] (10 m)	11.7	−2.8	11.9	−1.2	10.9	−0.7	9.1	−0.7	6.5	−1.1	4.6	−1.2	2.6	−1.1	−2.8	−1.5	−9.1	−1.7	15
Selfridge Field (Mount Clemens), Mich.[1] (177 m)	15.0	+0.7	16.6	+0.3	15.0	+0.4	12.7	+0.4	10.4	+0.4	7.8	+0.2	5.2	+0.1	−0.4	−0.1	−6.8	−0.6	28
Spokane, Wash.[2] (596 m)	9.9	−0.5	------	------	14.4	−0.4	12.9	−0.3	9.7	−0.2	6.3	−0.3	3.4	−0.2	−2.9	−0.4	−9.2	−0.4	30
Washington, D. C.[2] (13 m)	18.5	−1.2	19.7	+0.7	17.1	−0.1	14.3	−0.6	11.7	−0.9	9.5	−0.8	7.1	−0.7	1.9	−0.5	−2.7	+0.2	25
Wright Field (Dayton), Ohio[1] (244 m)	16.7	+1.8	20.3	+2.5	18.0	+0.9	16.0	+1.3	13.2	+1.0	10.6	+0.8	7.7	+0.7	1.9	+0.8	−3.5	+1.4	27

[1] Army. [2] Weather Bureau. [3] Navy.

TABLE 1.—*Mean free-air temperatures and relative humidities obtained by airplanes during September 1936*—Continued

RELATIVE HUMIDITY (PERCENT)

Stations	Altitude (meters) m. s. l.																Number of observations
	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	Mean	Departure from normal	
Barksdale Field (Shreveport), La.	86	------	74	------	72	------	71	------	70	------	61	------	55	------	58	------	41	------	------
Billings, Mont.	51	−5	------	------	------	------	47	−2	47	−1	50	+1	51	0	51	−4	50	−2	------
Boston, Mass.	82	------	72	------	66	------	64	------	62	------	52	------	44	------	40	------	34	------	------
Cheyenne, Wyo.	61	−4	------	------	------	------	------	------	57	−3	49	−1	47	−1	51	+3	50	+1	------
El Paso, Tex.	70	------	------	------	------	------	66	------	68	------	72	------	70	------	70	------	65	------	------
Fargo, N. Dak.	75	−4	62	−4	60	−2	53	−3	48	−5	45	−5	48	−2	51	+4	47	+2	------
Kelly Field (San Antonio), Tex.	94	0	88	+1	77	−2	71	−2	70	−1	67	+3	61	+2	59	+10	56	+9	------
Lakehurst, N. J.	87	−2	70	−2	65	−5	61	−3	60	0	55	0	51	+1	37	−5	32	−9	------
Maxwell Field (Montgomery), Ala.	91	0	71	+4	69	+2	71	+5	62	+6	56	+6	53	+6	47	+1	41	0	------
Miami, Fla.	93	------	80	------	75	------	73	------	72	------	69	------	65	------	58	------	53	------	------
Mitchel Field (Hempstead, L. I.), N. Y.	89	−2	76	−1	75	+2	71	+4	69	+5	59	+1	52	−3	42	−7	------	------	------
Murfreesboro, Tenn.	83	−4	66	−1	64	−2	67	0	68	+6	62	+5	57	+4	50	+3	34	−6	------
Norfolk, Va.	88	+8	72	+1	70	+2	68	+4	61	0	55	−2	50	−2	46	−1	44	−1	------
Oakland, Calif.	82	------	53	------	33	------	29	------	27	------	25	------	23	------	22	------	19	------	------
Oklahoma City, Okla.	74	−7	70	−5	65	+1	66	+4	65	+6	63	+7	62	+9	61	+12	59	+14	------
Omaha, Nebr.	83	−1	70	−3	58	+2	54	+1	51	0	49	0	49	+1	46	0	40	−3	------
Pearl Harbor, Territory of Hawaii	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------	------
Pensacola, Fla.	90	+5	79	+1	78	+3	77	+6	71	+4	63	+1	59	+1	54	0	50	0	------
Salt Lake City, Utah	58	------	------	------	------	------	42	------	37	------	38	------	40	------	42	------	43	------	------
San Diego, Calif.	84	+5	78	−1	49	−5	34	−8	33	−1	31	−1	31	0	33	+2	30	+5	------
Sault Ste. Marie, Mich.	88	------	77	------	71	------	67	------	61	------	57	------	64	------	54	------	51	------	------
Scott Field (Belleville), Ill.	86	−4	63	0	60	0	59	+1	63	+8	61	+7	57	+7	52	+4	46	+4	------
Seattle, Wash.	85	+6	77	+1	71	0	65	+1	59	+1	55	+1	48	−1	40	−4	36	−7	------
Selfridge Field (Mount Clemens), Mich.	87	0	69	−1	62	−2	58	−2	56	0	52	+1	49	0	45	+1	39	−2	------
Spokane, Wash.	78	+9	------	------	54	+3	50	+2	54	+4	57	+4	55	+3	51	+2	48	+3	------
Washington, D. C.	87	+8	59	−9	61	−4	64	+1	64	+4	55	0	48	−3	41	−7	28	−9	------
Wright Field (Dayton), Ohio	86	−3	64	−7	65	+1	64	0	65	+6	63	+10	60	+9	51	+4	46	+3	------

Observations taken about 4 a. m., 75th meridian time, except along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—The departures are based on normals covering the following total number of observations made during the same month in previous years, including the current month (Years of record are given in parentheses following the number of observations): Billings, 88 (3); Cheyenne, 90 (3); Fargo, 87 (3); Kelly Field, 88 (3); Lakehurst, 45 (3); Maxwell Field 86 (3); Mitchel Field, 73 (3); Murfreesboro, 89 (3); Norfolk 134 (7); Oklahoma City, 86 (3); Omaha, 180 (6); Pensacola, 195 (9); San Diego, 193 (7); Scott Field, 73 (3); Seattle, 61 (7); Selfridge Field, 88 (3); Spokane, 84 (3); Washington 233 (12); Wright Field, 83 (3).

TABLE 2.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during September 1936*

[Wind from N=360°, E=90°, etc.]

Altitude (m) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. (204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		Murfreesboro, Tenn. (180 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	360	1.2	121	0.3	272	1.6	313	1.3	297	2.6	179	0.7	45	1.0	312	0.3	174	1.2	69	1.1	94	1.8	192	0.8	174	1.1
500	------	------	132	1.7	------	------	292	4.4	------	------	194	3.8	213	2.7	226	1.2	207	2.4	167	4.8	103	3.9	230	0.5	182	5.6
1,000	------	------	169	1.8	------	------	282	5.0	------	------	226	2.8	248	5.9	259	2.3	239	3.8	169	5.7	109	3.9	315	0.6	211	6.4
1,500	------	------	221	1.3	269	2.7	286	5.3	------	------	264	2.6	256	5.2	265	3.9	284	6.1	166	5.4	102	2.8	71	0.8	226	4.8
2,000	121	0.9	196	0.3	274	2.8	272	8.0	288	3.6	263	3.8	248	5.0	270	5.6	287	6.6	170	4.7	107	2.4	60	1.2	233	3.2
2,500	255	1.8	132	0.3	260	4.9	------	------	271	4.2	264	5.1	250	5.0	280	7.0	286	9.7	170	4.3	103	2.3	310	0.5	233	2.7
3,000	260	2.2	299	0.5	258	7.1	------	------	259	4.1	252	6.4	263	4.4	273	8.2	257	6.3	172	3.9	93	2.1	328	1.7	249	2.4
4,000	242	2.5	296	2.8	256	10.0	------	------	255	5.1	257	7.8	286	8.2	283	8.9	------	------	183	2.3	94	1.4	319	2.4	246	3.7
5,000	226	1.3	246	3.4	257	10.8	------	------	261	5.5	------	------	------	------	282	7.0	------	------	180	2.2	------	------	280	4.1	------	------

Altitude (m) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68 m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	323	1.1	325	0.5	174	2.2	156	1.1	55	2.5	45	2.5	155	1.2	146	3.3	26	0.4	109	0.9	146	0.3	101	1.3	354	0.6
500	312	2.3	323	1.6	184	7.3	172	4.3	74	5.5	117	2.1	199	5.6	------	------	289	0.5	177	2.7	360	2.4	------	------	282	1.2
1,000	296	3.4	339	2.7	208	13.7	209	6.3	80	6.0	135	1.8	231	5.5	------	------	53	1.3	256	4.2	4	2.4	234	1.1	272	1.9
1,500	294	5.8	320	2.0	221	9.2	227	5.1	77	4.1	139	1.8	246	4.3	156	3.5	82	0.8	269	5.9	326	2.3	256	3.2	283	3.5
2,000	295	6.7	285	2.0	208	5.5	241	4.5	72	2.9	132	1.7	249	5.1	170	1.9	144	0.4	277	9.2	324	3.1	263	3.3	277	3.1
2,500	284	7.8	277	3.1	203	4.8	276	3.3	66	1.1	120	1.1	258	4.8	193	2.2	201	2.0	290	11.6	318	4.7	271	5.1	290	3.4
3,000	290	9.1	210	2.5	195	4.6	288	5.6	82	1.6	79	0.6	244	4.9	230	2.6	226	1.0	303	14.6	301	5.4	276	5.6	309	5.4
4,000	------	------	------	------	------	------	299	6.6	------	------	331	1.0	250	6.9	256	5.0	------	------	------	------	308	6.8	294	8.7	------	------
5,000	------	------	------	------	------	------	297	5.4	------	------	------	------	------	------	278	3.9	------	------	------	------	292	9.1	------	------	------	------

[1] Navy stations.

RIVERS AND FLOODS

[River and Flood Division, MONTROSE W. HAYES in charge]

By W. J. MOXOM

Torrential rainfall in central and northern Texas on September 15–17 and again on September 26–27, 1936, gave unusually high floods in the Colorado and Brazos Rivers and tributaries and moderately high floods in the Trinity, Guadalupe, and Nueces Rivers. Numerous cities and towns in both the Colorado and Brazos drainage basins suffered severely from these floods. In San Angelo, Tex., on the Conchas River, a tributary of the Colorado, approximately 300 homes were swept away, a large portion of the business district and 500 houses were flooded. In the entire flooded area the loss of life was comparatively small, only four persons were reported drowned, but the property losses were very great. Close estimates of property losses are not available, but it is believed they will exceed $5,000,000. The lower reaches of these rivers continued above flood stage at the close of the month.

The Saluda and Santee Rivers in South Carolina were in moderate flood, but losses on the main streams were negligible. Heavy rains on September 30 in northwestern South Carolina caused considerable local flooding in numerous small streams. Roads were damaged and a number of small bridges were destroyed.

Elsewhere flood stages were slightly exceeded at several river stations in widely separated areas, as shown by the table of flood stages below, with little or no losses reported.

Table of flood stages during September 1936

[All dates in September unless otherwise specified]

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
ATLANTIC SLOPE DRAINAGE					
	Feet			*Feet*	
Saluda: Pelzer, S. C.	6	30	(1)	13.5	30
Santee:					
Rimini, S. C.	12	6	7	12.3	6
		11	11	12.0	11
		17	20	12.5	19
Ferguson, S. C.	12	20	20	12.0	20
Savannah: Ellenton, S. C.	14	1	2	15.2	1

[1] Continued into October.

Table of flood stages during September 1936—Continued

River and station	Flood stage	Above flood stages—dates		Crest	
		From—	To—	Stage	Date
MISSISSIPPI SYSTEM					
Missouri Basin					
	Feet			*Feet*	
Big Sioux: Akron, Iowa	12	16	16	13.0	16
Solomon: Beloit, Kans.	18	28	28	18.7	28
Arkansas Basin					
North Canadian:					
Woodward, Okla.	5	5	5	5.0	5
		13	14	6.0	13
Canton, Okla.	6	14	14	6.0	14
Yukon, Okla.	8	15	19	9.8	18
Red Basin					
Sulphur: Ringo Crossing, Tex.	20	28	Oct. 1	22.0	28
WEST GULF OF MEXICO DRAINAGE					
Elm Fork: Carrollton, Tex.	6	28	30	9.4	28, 29
Trinity:					
Dallas, Tex.	28	27	(1)	35.2	28
Trinidad, Tex.	28	29	(1)	34.0	30
Brazos:					
Rainbow, Tex.	20	27	29	22.0	27
Waco, Tex.	27	27	30	40.9	27
Valley Junction, Tex.	44	30	Oct. 1	47.6	Oct. 1
Colorado:					
Marble Falls, Tex.	21	16	23	[2] 30.0	22
		27	(1)	[2] 28.0	27
Mud, Tex.	25	16	17	30.5	17
		23	23	28.6	23
		27	28	44.5	27
Austin, Tex.	21	16	18	25.0	17
		22	23	25.1	23
		27	28	32.9	28
Smithville, Tex.	25	24	25	26.2	24
		29	30	29.6	29
Columbus, Tex.	24	18	27	34.5	26
		29	(1)	34.9	30
Wharton, Tex.	26	19	(1)	36.6	28
Guadalupe:					
Gonzales, Tex.	20	17	19	28.5	18
		29	(1)	29.9	30
Victoria, Tex.	21	20	23	25.1	22
Nueces: Cotulla, Tex.	15	16	24	19.2	17
Rio Grande:					
Del Rio, Tex.	15	28	28	15.5	28
Eagle Pass, Tex.	16	28	28	16.2	28
		2	4	19.4	3
Brownsville, Tex.	18	16	19	19.5	17, 18
		21	23	19.3	22
		29			

[2] Gage destroyed, readings estimated.

WEATHER ON THE ATLANTIC AND PACIFIC OCEANS

[The Marine Division, I. R. TANNEHILL in charge]

NORTH ATLANTIC OCEAN, SEPTEMBER 1936

By H. C. HUNTER

Atmospheric pressure.—The average pressure for September was near normal over practically all the western half of the North Atlantic; but was slightly to considerably above normal over the easternmost portion. The departure at Lerwick, Shetland Islands, averaged +0.18 inch, in spite of a marked deficiency there and elsewhere over most northeastern districts from the 3d to the 10th. There was a slight deficiency of the monthly pressure around southern Greenland and a marked deficiency around the Azores; in the latter area the pressure during the second half was almost constantly below normal.

The extremes of pressure found in the regular mail reports are 30.58 and 28.49 inches, which occurred only about 42 hours and approximately 700 miles apart. The higher mark was noted on the American passenger liner *Washington*, at 8 a. m., the 16th, at latitude 41°30′ N., longitude 62°24′ W. The lower mark, at 12:30 a. m., the 18th, was recorded about 50 miles east of Cape Hatteras by the American steamship *Limon*, then very close to the center of the northward-moving hurricane of that date. A radio report indicates a pressure of 28.32 inches on the Swedish tankship *Nike*, as mentioned in the accompanying article on tropical disturbances.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure (sea level) at selected stations for the North Atlantic Ocean and its shores, September 1936*

Stations	Average pressure	Departure	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Julianehaab, Greenland	29.71	−0.05	30.18	27	28.94	30
Reykjavik, Iceland	29.84	+.12	30.39	25	29.32	10
Lerwick, Shetland Islands	30.02	+.18	30.56	16	29.24	7
Valencia, Ireland	30.03	+.04	30.42	15	29.53	3
Lisbon, Portugal	30.13	+.11	30.30	17, 22	29.86	19
Madeira	30.07	+.05	30.27	22	29.89	20
Horta, Azores	30.02	−.15	30.36	4	29.52	20
Belle Isle, Newfoundland	29.90	+.01	30.32	5	29.24	29
Halifax, Nova Scotia	30.07	+.02	30.46	15	29.50	28
Nantucket	30.09	+.01	30.47	14	29.27	19
Hatteras	30.04	−.02	30.28	15	28.89	18
Bermuda	30.09	+.01	30.20	18, 27	29.90	2
Turks Island	29.95	−.03	30.03	24	29.87	16
Key West	29.95	+.01	30.05	24	29.86	16
New Orleans	29.98	.00	30.10	8	29.83	29

NOTE.—All data based on a. m. observations only, with departures compiled from best available normals related to time of observation, except Hatteras, Key West, Nantucket, and New Orleans, which are 24-hour corrected means.

Cyclones and gales.—Elsewhere appears an account of the storms of tropical origin during September. Practically all the noteworthy storm activity before the 26th over the northern part of the North Atlantic was at least closely connected with storms of tropical origin. The hurricane which passed east of Bermuda on the 2d was approximately midway between Cape Race, Newfoundland, and Horta by late evening of the 4th. This storm and a storm from the vicinity of New England apparently merged and the resulting LOW showed considerable strength near the British Isles on the 6th and 7th, the center being close to northern Scotland on the latter date, when a wind of force 11 was noted in the southwestern part of the North Sea. The center then proceeded over the southern part of the Baltic Sea.

The hurricane of the 8th to 26th caused winds of force 11 or 12 on the 19th to the southeastward of Long Island and the Massachusetts coast, and on the 20th and 21st near and slightly to the eastward of the Grand Banks. Its force was apparently less to eastward of the fortieth meridian on the succeeding days, but gales were noted near the Azores and for moderate distances to northward about the 22d to 25th. Comparatively few lives were lost as a result of this storm; it is believed that all hands were saved when the fishing steamer *Long Island* sank in lower Delaware Bay on the 18th. Chart IX indicates the situation on the 16th, while both this hurricane and the later one appear upon chart X, for the 23d.

The hurricane of the 19th to 24th did not closely approach the coast of the United States till it was north of the fortieth parallel. This storm, merging with a storm from a westerly area near Novia Scotia about the 25th, seems to have been connected with the strong to whole gales noted southeast of Newfoundland on the 26th and 27th. On the latter date another disturbance was over the Lake region, and this became a storm of great strength near Newfoundland on the 28th and 29th. The American steamship *Memphis City*, when about 300 miles east-northeast of Belle Isle on the 29th and 30th, noted winds at one time of force 11, and estimated the height of the seas as 80 feet. The ship was forced to run before the storm for 30 hours. Press reports indicate that four schooners were wrecked on the Labrador coast and one or two others on the Newfoundland shores.

Local squall in tropics.—The British motor vessel *Husvik*, which reached Port au Price Harbor, Haiti, late on the 4th, there encountered, about 6:20 to 8 p.m., a severe squall or storm, with the wind attaining force 9 for a time and always from a northeasterly direction. The barometer was throughout at about normal height (30.03 inches the lowest), so the phenomenon probably was confined to a very small area.

Fog.—There was considerably less fog over the greater part of the North Atlantic, north of the fortieth parallel of latitude, than is usually noted during September. Compared with August the decrease in fogginess was marked. Between the fortieth and twenty-fifth meridians September brought scarcely any fog; but, on the other hand, just west of the Bay of Biscay and the English Channel, the square between 45° and 50° N., 5° and 10° W., had 7 days with fog, which is more than usually occurs in that area.

Over the Grand Banks and waters around Newfoundland, and thence southwestward and westward to the east coast of New England there was mostly about as much fog as usual in September. The square from 40° to 45° N., 65° to 70° W., reported 12 days with fog. While there was less fog than this from southern New England to the vicinity of the Chesapeake capes, yet it was much more than normally occurs there at the time of year. To southward of Hatteras no fog at all was reported.

Two collisions due to fog occurred near the American shores. Just outside Boston harbor, on the 9th, two passenger boats came together and the smaller soon sank, but apparently without loss of life. During the foggy period from the 21st to 25th, two steamships collided in East River, near Hell Gate; one of them sank but was duly raised; also a tanker grounded in Boston harbor, but was shortly refloated.

OCEAN GALES AND STORMS, SEPTEMBER 1936

Vessel	Voyage		Position at time of lowest barometer		Gale began September	Time of lowest barometer September	Gale ended September	Lowest barometer	Direction of wind when gale began	Direction and force of wind at time of lowest barometer	Direction of wind when gale ended	Direction and highest force of wind	Shifts of wind near time of lowest barometer
	From—	To—	Latitude	Longitude									
NORTH ATLANTIC OCEAN			° ′	° ′				*Inches*					
Bergensfjord, Nor. S. S.	Bergen	New York	55 00 N.	35 30 W.	1	4p, 1	2	29.46	WSW.	WNW, 7.	NNW.	NW, 9.	W-NW.
Burgerdijk, Du. S. S.	Rotterdam	Habana	31 48 N.	54 13 W.	2	3p, 2	2	29.74	SE.	S, 8.	S.	SE, 9.	SSE-S.
Alberta, Ital. S. S.	Gibraltar	Boston	36 00 N.	56 11 W.	2	10p, 2	3	29.63	SSE.	NE, 8.	N.	NNE, 9.	ENE-NNE.
Ida Z. O., Ital. S. S.	do	do	43 07 N.	35 50 W.	5	10a, 5	5	29.70	SW.	SW18.	SW.	SW, 9.	
Sunetta, Du. M. S.	Cristobal	Hull	48 03 N.	21 20 W.	5	6a, 6	7	[1]29.21	SW.	W, 8.	WNW.	W, 9.	SW-W.
Tactician Br. S. S.	Liverpool	Kingston	47 24 N.	10 32 W.	6	1p, 6	7	29.55	SSW.	SSW, 9.	NW.	SSW, 9.	SSW-W.
Colombia, Du. M. S.	Dover	Ponta Delgada, Azores.	48 21 N.	6 21 W.	6	9p, 6	7	29.46	S.	SSW, 10.	WNW.	SSW, 10	SSW-WSW.
West Kyska, Am. S. S.	Flushing	Tampa	52 06 N.	4 00 E.	7	8a, 7	8	29.07	W.	W, 8.	W.	W, 11	
Eastern Prince, Br. M. S.	New York	Rio de Janeiro	19 05 N.	51 15 W.	9	3a, 10	10	29.91	NE.	ESE, 7.	ESE.	NE, 8.	NE-ESE.
Nemaha, Am. S. S.	Galveston	Tampico	26 00 N.	95 00 W.	12	3a, 13	13	29.77	E.	SE, 7.	SSE.	SE, 8.	ESE-SE.
Motocarline, Belg. M. S.	Antwerp	Aruba	22 33 N.	59 58 W.	13	2p, 13	14	[1]29.58	SE.	SSE, 9.	SSW.	SE, 10.	SE-SSE.
Sheridan, Br. S. S.	Para	New York	28 42 N.	71 08 W.	13	6p, 16	17	29.38	NE.	NW, 10.	S.	NNW, 10.	N-NW-SSW.
American Merchant, Am. S. S.	New York	London	47 30 N.	33 42 W.	16	4a, 17	17	29.79	NE.	ENE, 8.	ENE.	NE, 10.	NE-ENE.
Allan Jackson, Am. S. S.	Boston	Baytown, Tex.	32 30 N.	74 36 W.	17	11a, 17	17	29.29	NNE.	N, 10.	WNW.	N, 10	N-NW.
Seminole, Am. S. S.	New York	Galveston	[2]34 42 N.	75 52 W.	17	2p, 17	17	29.55	ENE.	NNE, 9.	N.	NNE, 10.	ENE-NNE-N.
Yucatan, Am. S. S.	do	Habana	34 42 N.	75 40 W.	17	5p, 17	17	29.46	NE.	N, 10.	NW.	N, 10	NE-N.
El Almirante, Am. S. S.	New Orleans	New York	34 24 N.	75 01 W.	17	7p, 17	18	29.10	NNE.	N, 9.	W.	NE, 9.	NE-N-W.
Whipple, Nic. M. S.	Norfolk	Cap Haitien	33 04 N.	76 28 W.	17	9p, 17	18	29.64	NE.	NNW, 12.	NW.	NW, 12.	NNW-NW.
Virginian, Am. S. S.	New York	Cristobal	35 35 N.	72 00 W.	17	11p, 17	18	28.59	NE.	SE, 10.	WSW.	NE, 12.	NE-SE.
Limon, Am. S. S.	Boston	Tela	[2]35 12 N.	74 25 W.	17	1a, 18	18	28.49	ENE.	E, 6.	SW.	NE, 11.	E-Calm-NW.
El Occidente, Am. S. S.	New York	Galveston	36 10 N.	74 50 W.	17	5a, 18	18	28.60	NE.	NE, 9.	W.	NE, 12.	NE-NW-W.
El Lago, Am. S. S.	do	New Orleans	Chesapeake Bay		18	7a, 18	18	29.35	NNE.	N, 12.	NNW.	N, 12.	NE-NW.
Wm. Rockefeller, Am. S. S.	do	Aransas Pass	37 15 N.	76 06 W.	16	10a, 18	19	29.23	NE.	N, 12.	NW.	NNE, 12.	NNE-N.
Cities Service Kansas, Am. S. S.	do	Port Arthur	36 50 N.	73 45 W.	17	2p, 18	18	28.84	ENE.	SW, 12.	W.	SE, 12	SE-SW-WSW.
Gulfking, Am. S. S.	Providence	do	38 27 N.	72 30 W.	17	7p, 18	19	28.65	ENE.	SE, 2.	NNW.	SE, 11	SE-W.
Monarch of Bermuda, Br. S. S.	Bermuda	New York	39 12 N.	71 50 W.	18	2a, 19	19	28.65	SE.	SE, 12.	N.	SE, 12	SE-WSW-NW.
American Importer, Am. S. S.	Belfast	Boston	42 42 N.	68 12 W.	19	10a, 19	19	29.50	NE.	NE, 9.	NNW	NE, 10	
Maria, Ital. M. V.	Algiers	New York	36 19 N.	33 50 W.	19	10a, 19	20	29.85	NNW.	NNW, 5.	NNW.	NNW, 9.	
Columbus, Ger. S. S.	Bremerhaven	do	40 36 N.	66 20 W.	19	11a, 19	19	29.33	S.	SSW, 12.	NW.	SSW, 12.	S-SW.
Sliedrecht, Du. M. S.	Hamburg	Philadelphia	42 20 N.	56 30 W.	19	4a, 20	20	29.32	S.	WSW, 9.	N.	WSW, 10.	WSW-NW.
Maasdam, Du. S. S.	Rotterdam	New York	46 08 N.	54 00 W.	20	7a, 20	20	29.45	ESE.	NE, 9.	NNE.	NE, 10.	E-NNE.
Colorado Springs, Am. S. S.	New Orleans	Liverpool	42 30 N.	50 23 W.	19	2p, 20	21	29.40	S.	SW, 8.	N.	NW, 10.	SSW-W.
Falsterbo, Swed. M. S.	Rotterdam	Cristobal	35 30 N.	31 45 W.	20	6p, 20	21	29.31	NW.	N, 6.	N.	N, 9.	NNW-NNE.
Binnendyk, Du. S. S.	do	Bridgeport	45 16 N.	48 26 W.	20	6p, 20	21	29.12	E.	SSW, 3.	N.	NNW, 11.	E-SSW-NNW.
Paris, Fr. S. S.	Southampton	New York	45 29 N.	42 55 W.	21	11a, 21	21	29.21	SSE.	W, 4.	NNW.	NW, 12.	SW-W-NW.
Gulfwing, Am. S. S.	Las Piedras	Philadelphia	[2]27 12 N.	71 03 W.	20	8p, 21	22	29.54	NW.	W, 10.	NNW.	WNW, 10	NW-W-NW.
Heddernheim, Ger. S. S.	Husum	Boston	52 12 N.	41 08 W.	21	Noon, 22	23	29.94	E.	N, 9.	NW.	N, 10.	
Saramacca, Am. S. S.	Boston	Baracoa	28 55 N.	69 45 W.	21	Noon, 22	25	28.94	ESE.	SSW, 12.	WNW.	SSW, 12.	SSE-SSW-W.
Jean Jadot, Belg. S. S.	Antwerp	New York	42 29 N.	63 36 W.	24	8p, 24	25	29.41	SE.	SE, 10.	SW.	SE, 10.	SE-SW.
Exchange, Am. S. S.	Lisbon	do	42 42 N.	46 00 W.	27	8a, 27	27	29.39	W.	WNW, 10.	NNW.	WNW, 10.	W-NW.
Duivendrecht, Du. M. S.	Houston	Rotterdam	46 14 N.	37 00 W.	29	Noon, 29	30	29.23	SSW.	S, 7.	WSW.	WSW, 9.	SSW-S-SW.
Memphis City, Am. S. S.	Swansea	Montreal	53 20 N.	47 00 W.	29	4p, 29	[3]1	28.63	N.	N, 9.	NW.	NW, 11.	NE-NW.
Leto, Du. S. S.	Montreal	London	53 09 N.	20 28 W.	29	8p, 30	30	29.55	SE.	SSE, 9.	SSW.	SSE, 9.	SSE-SSW.
NORTH PACIFIC OCEAN													
Pres. Grant, Am. S. S.	Yokohama	Victoria, B. C.	49 00 N.	130 05 W.	[4]31	Noon, 1	1	29.75	NW.	Calm.	NNW.	NW, 9.	
Silverwillow, Br. M. S.	Dahikan	Los Angeles	20 30 N.	131 45 E.	1	4p, 1	2	29.35	N.	SW, 6.	SE.	SSE, 8.	NNW-SW-SSE.
Pres. McKinley, Am. S. S.	Victoria, B. C.	Yokohama	52 06 N.	155 12 W.	1	2p, 2	2	29.99	WSW.	SW, 6.	SW.	SW, 9.	S W - S S W - WNW.
Texas, Am. S. S.	Siain, P. I.	San Francisco	[2]42 21 N.	157 25 W.	5	6p, 6	6	30.43	NE.	NE, 7.	ENE.	NE, 8.	NE-ENE.
Kwanto Maru, Jap. M. S.	Los Angeles	Yokohama	44 27 N.	167 09 E.	6	10p, 6	6	29.57	SE.	WSW, 2.	SSE.	ESE, 8.	S-NW.
Pres. McKinley, Am. S. S.	Victoria, B. C.	do	48 18 N.	166 30 E.	7	8a, 7	7	29.57	E.	E, 7.	E.	E, 8.	E-N.
Lossiebank, Br. M. S.	San Francisco	Manila	22 50 N.	165 46 E.	7	6a, 8	8	[1]29.72	S.	SW, 8.	WSW.	S, 9.	S-WSW.
Mauna Kea, Am. S. S.	Los Angeles	Balboa	20 06 N.	106 42 W.	8	1p, 8	8	29.65	E.	SE, 9.	SSE.	SE, 9.	E-SE.
Texan, Am. S. S.	do	do	21 20 N.	108 40 W.	8	3a, 9	9	29.25	E.	SE, 12.	S.	SE, 12	E-SE.
Greylock, Am. S. S.	do	do	22 22 N.	109 25 W.	9	7a, 9	9	29.28	E.	NNW, 11.	W.	NNW, 11.	E-N-W.
Mana, Am. S. S.	Hilo	San Francisco	[2]37 00 N.	125 12 W.	8	4a, 10	10	29.84	N.	NW, 8.	NW.	NW, 8.	None.
General Lee, Am. S. S.	Yokohama	do	45 08 N.	164 50 E.	10	2a, 11	11	29.55	NW.	N, 5.	N.	NW, 8.	
Norfolk Maru, Jap. S. S.	do	Los Angeles	34 18 N.	120 18 W.	10	4p, 11	10	29.72	N.	WNW, 3.	NNW.	N, 8.	
Texan, Am. S. S.	Los Angeles	Balboa	15 28 N.	99 42 W.	11	5p, 11	11	29.73	SSW.	SSW, 6.	WSW.	WSW, 8.	SSW-WSW.
Nankai Maru, Jap. M. S.	Yokohama	Los Angeles	44 48 N.	169 00 E.	14	11p, 14	14	29.58	W.	W, 8.	W.	W, 8.	NW-W.
Pres. Grant, Am. S. S.	Victoria, B. C.	Yokohama	51 25 N.	172 10 W.	17	6p, 17	19	29.49	SW.	W, 7.	NW.	SW, 8.	SW-W.
Washington, Am. S. S.	Yokohama	Los Angeles	45 12 N.	152 12 W.	21	2a, 22	22	29.67	SSE.	SW, 7.	WSW.	SW, 8.	SSE-SW.
Golden Tide, Am. S. S.	Catabangan, P. I.	San Francisco	41 55 N.	178 00 W.	23	1p, 23	24	29.16	WNW.	WNW, 12.	N.	NW, 12.	W-NW.
Pres. Jackson, Am. S. S.	Yokohama	Seattle	49 32 N.	175 26 W.	24	4p, 24	25	29.75	N.	NW, 9.	W.	NW, 9.	NNW-NW.
Nebraskan, Am. S. S.	Los Angeles	Balboa	[2]20 26 N.	107 02 W.	25	6p, 25	26	29.64	SE.	SE, 6.	SW.	SW, 8.	ESE-SSE.
Hiye Maru, Jap. M. S.	Yokohama	Vancouver	49 34 N.	176 48 W.	27	Noon, 27	27	28.77	NNW.	WNW, 8.	NW.	NW, 9.	NNW-WSW.
Hokuroku Maru, Jap. M. S.	do	Los Angeles	45 25 N.	179 59 W.	30	4a, 30	30	29.39	WNW.	NW, —.	W.	WNW, 8.	NW-WNW.

[1] Barometer uncorrected. [2] Position approximate. [3] October. [4] August.

NORTH PACIFIC OCEAN, SEPTEMBER 1936

By WILLIS E. HURD

Atmospheric pressure.—During most of the first 9 days of September strong anticyclonic conditions overlay the Aleutian region. Thereafter there was a reaction to low pressure, and the average barometer for the month at both St. Paul and Dutch Harbor, 29.77 inches, was only slightly above the normal for the month. The Aleutian LOW was well established as a whole over much of the northern part of the ocean, especially to the westward and southwestward of the Alaska Peninsula. Pressures above normal continued along the coast from Alaska to Washington, as shown by table 1, but were below normal from San Francisco southward.

High pressures extended from British Columbia and the northwestern United States southwestward to beyond Midway Island. Anticyclonic conditions were spreading

over northern Japanese waters from Mongolia during the month, but low pressures continued over the region of the lesser Japanese islands and the Philippines.

TABLE 1.—*Averages, departures, and extremes of atmospheric pressure at sea level, North Pacific Ocean, September 1936, at selected stations*

Stations	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Inches	*Inch*	*Inches*		*Inches*	
Point Barrow	29.98	+0.08	30.46	11	29.58	1
Dutch Harbor	29.77	+.01	30.56	7	29.10	19
St. Paul	29.77	+.06	30.48	8	29.00	18
Kodiak	29.87	+.16	30.38	27	29.14	20
Juneau	29.98	+.06	30.40	25	29.46	19
Tatoosh Island	30.08	+.08	30.47	15	29.64	13
San Francisco	29.88	−.06	30.09	14	29.63	3
Mazatlan	29.80	−.02	29.88	15	29.64	26
Honolulu	29.97	−.03	30.04	1	29.83	6
Midway	30.03	+.02	30.18	17	29.92	22
Guam	29.80	−.03	29.90	1	29.68	10
Manila	29.75	−.02	29.84	7, 15	29.68	26
Hong Kong						
Naha	29.77	+.01	29.94	20	29.24	30
Chichishima	29.85	−.01	30.04	2	29.62	1, 22
Urakawa	30.00		30.26	19	29.70	25

NOTE.—Data based on 1 daily observation only, except those for Juneau, Tatoosh Island, San Francisco, and Honolulu, which are based on 2 observations. Departures are computed from best available normals related to time of observation.

Extratropical cyclones and gales.—Following the generally quiet weather of July and August in northern Pacific waters, some increase in storminess was experienced in September, especially over that part of the ocean to the northward of the fortieth parallel between meridians 150° W. and 160° E. The weather, however, was not severe, except locally on the 23d, when the American steamer *Golden Tide* encountered winds of hurricane force, barometer 29.16, near 42° N., 178° W. In all other instances reported the wind did not exceed force 9.

Of the four most important cyclones in higher latitudes the first lay central over northern Japan and the Kuril Islands on September 6. It expanded with eastward movement and covered a great part of the northwestern ocean on several days. It crossed the Aleutians as a moderately deep disturbance during the 13th to 16th, then moved northward into Alaska. Resulting gales were reported on several days in scattered localities, principally in east longitudes, from the 6th to 14th.

The second cyclone was centered over the Bering Sea on the 17th to 19th, lowest pressure at St. Paul, 29 inches, on the 18th. This caused fresh gales on all 3 days immediately south of the Aleutians.

From the 22d to 24th the cyclone that caused the gale of force 12 experienced on the 23d by the *Golden Tide*, and of less force by other ships on the 24th, crossed the northern routes south of the Aleutians, then moved rapidly toward the Arctic Ocean.

This cyclone was succeeded by the deepest storm of the month in Aleutian waters. Scattered gales of force 8–9 accompanied it in northern midocean from the 26th to 30th. On the 27th the Japanese motorship *Hiye Maru* reported a barometer of 28.77, near 49½° N., 177° W., and on the 30th the lowest pressure of the month, 28.67 inches, was read on the motorship *San Diego* near 50° N., 172° W.

From the 8th to 10th of September, while an elongated region of low pressure extended along the American coast between approximately 20° and 40° N., fresh north to northwest gales occurred on the 9th and 10th near and to the northward of Point Conception. In the southern part of this LOW a tropical disturbance had a brief period of existence.

Disturbances off the west coast of Mexico.—Three disturbances occurred off the Mexican west coast during the month.

The first was the cyclone, which has been referred to as developing over the southern area of an elongated depression extending far northward. It first appeared to observation on the 8th in the vicinity of Cape Corrientes. At 8 a. m. (local time) the American steamer *Deroche*, southbound, had an east wind of force 6 in 20°25′ N., 107°57′ W. At local noon, with falling barometer, in 20°02′ N., 107°32′ W., the wind had risen to force 7. Five hours later, in 19°36′ N., 107°06′ W., the ship was in a southeast gale of force 9–10, uncorrected barometer 29.51.

As the storm moved northward into the Gulf of California its violence increased. From 6 to 8 a. m. of the 9th the American steamer *Greylock* reported a minimum pressure reading of 29.28, in 22°22′ N., 109°25′ W., accompanied by north-northwesterly gales of force 10–11, during the continuance of which the ship hove to. At 2:30 a.m. of this date the American steamer *Texan*, in 21°20′ N., 108°40′ W., recorded a pressure of 29.25 inches, with hurricane winds from east to southeast which continued during the early morning hours.

After crossing Cape San Lucas, the storm apparently diminished rapidly in intensity, and on the 10th was completely dissipated.

On September 11, as the *Texan* voyaged toward the Canal, she ran into disturbed weather south of Acapulco during which she experienced a west-southwest gale of force 8 at 8 p. m. It appears that, as a depression was then making up in the Bay of Campeche, the gale on the Pacific side was associated with this Gulf of Mexico disturbance.

During the 24–26th unsettled weather was again experienced, the disturbed region extending approximately from Manzanillo across the lower part of the Gulf of California, with little progressive movement. The Olson Line steamer *San Pedro*, according to a special report to the Hydrographic Office at San Francisco, prepared by Capt. William E. Hutton, entered the disturbed locality late on the 24th, in 22°25′ N., 109°45′ W., several hours after receiving a radio report from Mazatlan forecasting bad weather off Cape Corrientes. During the day an unnamed vessel off Manzanillo reported a southeast wind, force 7. On the morning of the 25th the *San Pedro*, in 21°14′ N., 108°16′ W., had a rapidly falling barometer and "winds of cyclonic force." Heavy winds from east to southeast and rain squalls continued through most of the 5th, with lowest barometer on ship, 29.60, at 3 p. m., in 20°34′ N., 107°20′ W. It was not until 2:30 a. m. of the 26th, when the *San Pedro* was near Cape Corrientes, that the wind shifted to south and south-southwest in a gale and the storm began to diminish. The highest wind reported in connection with this cyclonic disturbance was of force 8, southwest, near midnight of the 25th, observed on the American S. S. *Nebraskan*, at about 20½° N., 107° W.

Typhoons.—Subjoined is an account, by the Reverend Bernard F. Doucette, S. J., Manila Observatory, of the tropical disturbances which occurred in the waters of the Far East during September.

Fog.—Fog was observed on several days along practically the entire course of the northern steamer routes, but was most widely reported on the 7th to 12th along the middle part of the routes, or between 40° and 50° N., 165° E. and 150° W. The most southerly occurrence reported this month was on the 7th near 19° N., 131° W. Fog was noted on 4 days in waters bordering on Washington and Vancouver Island, and on 6 days off the California coast.

TYPHOON AND DEPRESSIONS OVER THE FAR EAST, SEPTEMBER 1936

By Rev. BERNARD F. DOUCETTE, S. J.

[Weather Bureau, Manila, P. I.]

A total of five disturbances, one typhoon and four depressions, occurred over the Far East during September 1936. Toward the end of the month, a depression intensified into a typhoon which continued in existence during the first part of October and will be included in the report of that month.

On September 7, there was a small typhoon center which was not reported until the S. S. *Malayan Prince* arrived in Manila. This ship was not affected by the storm, but the M. S. *Lossiebank*, en route to Manila, had to change her course for a few hours to avoid the typhoon center. Her noon positions were, September 7, latitude 23°43′ N. longitude 167°44′ E. and September 8, latitude 22°36′ N., longitude 163°52′ E. On the afternoon of the 7th she took a southerly course to avoid the center, met southerly winds of hurricane force, had overcast skies with passing showers, minimum barometer 29.74 at 4 a. m. September 8. Tokyo broadcasted the following warning, September 7: "Typhoon lower than 742 between longitude 165° and 167°, latitude 24°–27° moving northeast probably stormy within 300 km radius from the center." Nothing is known at the time of preparing this report concerning either the formation of this typhoon or its future course.

Typhoon, August 28 to September 6, 1936.—A mild depression formed about 300 miles northeast of Yap, moved northwest then north-northwest to a position about 90 miles south-southwest of Naha, Nansei Islands. There it intensified into a typhoon, which moved rapidly northwest, then north by west to the Yellow Sea. It now recurved (Sept. 4) to the northeast and crossed the Sea of Japan on its way to the northern part of the Pacific Ocean.

As an indication of the extent and the intensity of the typhoon, Gutzlaff reported September 3, 2 p. m., a pressure of 741.9 mm (29.21 inches) with north-northwest winds force 6, while Shanghai at the same time had 755.7 mm (29.75 inches) with northeast winds, force 3.

Depression, August 30 to September 7, 1936.—A depression formed over the Mariana Islands, moved northwest, then west across the ocean. When about 350 miles east of Luzon (Sept. 3), it shifted its course to the northwest, crossed Bashi Channel and at once began to incline to the west by south. It continued to the Gulf of Tong King, which it crossed on its way into Indochina. Pratas reported a pressure of 751.9 mm (29.60 inches) with winds of force 3, as the depression passed the locality, September 4 and 5.

Depression, September 8 to 11, 1936.—A depression of little importance formed in the Pacific Ocean about 500 miles east of southern Luzon, moved west, then northwest, and filled up east of the Balintang Channel.

Depression, September 10 to 16, 1936.—A mild depression appeared northeast of Guam, moved in a northwesterly direction, and filled up about 600 miles east of Formosa.

Depression, September 26 to 28, 1936.—A depression formed in the China Sea about 360 miles west-northwest of Manila and moved northeastward to the western part of the Balintang Channel. There it was stationary for 2 days, after which no indication of its existence could be found. The S. S. *President Garfield* experienced the worst weather caused by this disturbance, having north winds force 6 with pressure of 747.8 mm (29.44 inches) at 6 a. m. September 27.

SEA-SURFACE TEMPERATURE SUMMARY FOR THE SOUTHWESTERN PORTION OF THE FLORIDA STRAITS, 1912–33

By GILES SLOCUM

The monthly mean sea-surface temperatures in the area bordering the northern coast of Cuba, between the Yucatan Channel and the Straits of Florida, are given in the accompanying table. The period covered is January 1912 to December 1933, inclusive. There are 13 months, as noted in the table for which no observational data are available. The observations for the first decade of the period treated, from 1912 to 1921, were few in number. The average temperatures for this period are therefore given to whole degrees. The mean temperatures for the years 1922 to 1933 are given to tenths of a degree.

The area from which these temperature observations were taken embraces two 1° squares, namely, between 23° N. and 24° N., and between 82° W. and 84° W.

This is the eighth of a series of temperature-history tabulations of this character showing sea-surface temperatures for small areas in American waters. The first of the series appeared in the November 1934 issue of the MONTHLY WEATHER REVIEW and the last previous tabulation appeared in the August 1936 issue.

Monthly and annual sea-surface temperatures in the southwestern portion of the Florida Straits, 1912 to 1933, inclusive

Year [1]	Total number of observations for the year	January	February	March	April	May	June	July	August	September	October	November	December	Annual [2]
1912	59	77	76	78	78	80	82	81	83	81	81	80	74	79.3
1913	45	76	77	77	77	77	80	82	84	83	83	77	77	79.1
1914	53	76	74	72	78	79	78	83	83	84	83	80	80	79.2
1915	30	79	75	74	77	79	84	85	86	83	84	[3]	79	[4] 80.6
1916	58	77	[3]	74	77	78	81	81	83	84	81	78	78	[4] 79.0
1917	16	73	73	77	77	[3]	80	[3]	82	[3]	[3]	[3]	75	[4] 77.8
1918	18	[3]	[3]	76	[3]	80	84	84	84	82	83	78	[3]	[4] 80.2
1919	37	82	76	79	[3]	80	82	82	83	83	82	80	78	[4] 80.4
1920	49	74	76	75	[3]	79	81	81	82	82	81	78	79	[4] 78.8
1921	74	76	77	76	78	80	80	82	83	83	82	79	78	79.6
1922	92	77.5	75.4	77.2	78.7	80.2	81.9	82.3	83.3	82.9	80.6	80.6	77.3	79.8
1923	134	79.8	78.7	78.2	79.2	80.2	81.3	81.9	82.4	82.6	81.3	76.8	78.3	80.1
1924	149	76.8	75.0	76.6	77.9	79.9	82.8	83.9	83.8	83.4	80.2	79.3	77.6	79.8
1925	235	77.0	76.4	76.9	77.8	80.2	81.5	82.8	84.2	83.8	82.7	81.6	77.7	80.2
1926	313	77.6	76.3	75.8	78.6	80.2	81.9	83.8	83.9	83.4	83.3	79.7	79.5	80.3
1927	314	77.2	76.8	77.5	78.5	80.5	82.4	83.0	83.9	83.9	82.0	80.3	77.7	80.3
1928	350	75.6	76.4	77.5	77.3	78.5	82.4	83.2	83.6	83.4	82.7	79.9	78.7	79.9
1929	370	77.3	76.9	77.6	79.0	80.3	81.7	82.8	82.9	82.6	81.8	80.7	78.7	80.2
1930	338	77.6	76.4	77.4	77.7	80.1	82.0	83.1	83.9	83.6	81.4	80.5	77.6	80.1
1931	300	76.0	77.7	76.6	76.4	79.3	82.0	83.7	84.5	84.1	82.4	79.5	80.1	80.2
1932	246	78.9	78.5	77.8	77.0	80.4	82.8	84.3	84.8	84.9	82.5	81.2	78.2	80.9
1933	197	77.6	78.0	78.3	79.7	80.8	82.1	83.1	83.7	83.7	81.9	79.7	79.1	80.6
Number of years' record		21	20	22	19	21	22	21	22	21	21	20	21	22
Mean, 1912–33 [3]		77.1	76.4	76.6	77.8	79.7	81.8	82.7	83.6	83.1	82.0	79.5	78.0	[4] 79.9

[1] Values for 1912 to 1921, inclusive, given to whole degrees instead of to tenths, because of paucity of data.
[2] Computed with monthly values figured to 1 decimal place, and, therefore, not exact means of the figures given in the table.
[3] No data.
[4] Interpolated values used for missing months.

CLIMATOLOGICAL TABLES

CONDENSED CLIMATOLOGICAL SUMMARY

In the following table are given for the various sections of the climatological service of the Weather Bureau the monthly average temperature and total rainfall; the stations reporting the highest and lowest temperatures, with dates of occurrence; the stations reporting the greatest and least total precipitation; and other data as indicated by the several headings.

The mean temperature for each section, the highest and lowest temperatures, the average precipitation, and the greatest and least monthly amounts are found by using all trustworthy records available.

The mean departures from normal temperatures and precipitation are based only on records from stations that have 10 or more years of observations. Of course, the number of such records is smaller than the total number of stations.

Condensed climatological summary of temperature and precipitation by sections, September 1936

[For description of tables and charts, see REVIEW, January, p. 29]

Section	Temperature								Precipitation					
			Monthly extremes								Greatest monthly		Least monthly	
	Section average	Departure from the normal	Station	Highest	Date	Station	Lowest	Date	Section average	Departure from the normal	Station	Amount	Station	Amount
	°F.	°F.		°F.			°F.		In.	In.		In.		In.
Alabama	78.5	+2.8	Riverton	100	10	Valley Head	46	25	2.80	−0.72	Florence	6.74	Clanton	0.57
Arizona	72.9	−1.3	Agua Caliente	115	9	Fort Valley	22	28	1.46	+.22	Fort Grant	5.10	7 stations	.00
Arkansas	78.9	+4.5	2 stations	109	5	Dutton	38	30	4.75	+1.35	Freeman Springs	13.52	Yancopin	.27
California	68.7	+1.1	Cow Creek	115	[1] 1	Twin Lakes	18	14	.16	−.29	Elsinore	2.22	103 stations	.00
Colorado	58.5	+.6	Lamar	103	10	Fraser	10	30	1.63	+.31	Westcliff	5.26	Grover (near)	T
Florida	80.6	+1.2	6 stations	98	[1] 3	Cottage Hill	56	1	4.44	−2.26	Fort Pierce	10.33	Gainsville	1.08
Georgia	77.3	+1.8	2 stations	101	19	Blairsville	47	[1] 1	4.50	+.79	Cornelia	12.05	Tifton	.80
Idaho	56.3	−.5	Lapwai	101	8	Bostetter	5	15	.55	−.50	Priest River	2.84	2 stations	.00
Illinois	71.2	+4.2	2 stations	102	[1] 12	Danville	37	25	6.77	+3.09	Walnut	12.10	Newton	2.33
Indiana	70.7	+3.5	do	105	[1] 13	Wheatfield	34	25	4.84	+1.42	Brookville	9.98	Evansville	2.15
Iowa	68.0	+4.3	6 stations	102	11	Sibley	31	30	7.22	+3.36	Winterset	10.79	Sioux City	2.07
Kansas	72.5	+2.9	4 stations	107	6	Tribune	31	28	4.84	+1.98	Parsons	10.72	Johnson	.97
Kentucky	74.4	+3.8	3 stations	101	[1] 12	Maysville	41	25	3.57	+.59	Fords Ferry	6.71	Stearns	1.15
Louisiana	80.9	+2.9	Plain Dealing	104	5	Plain Dealing	52	30	2.73	−1.17	Port Sulphur	7.64	Lake Providence	T
Maryland-Delaware	69.3	+1.4	Western Port, Md.	97	16	Hancock, Md.	29	26	2.40	−.77	Millsboro, Del.	7.67	Great Falls, Md.	.92
Michigan	62.2	+1.8	2 stations	94	11	Newberry	18	25	5.01	+1.76	Centerville	9.36	Munising	1.89
Minnesota	62.0	+3.0	4 stations	101	22	Detroit Lakes	21	29	2.07	−.80	Grand Meadow	5.34	Moorhead	.26
Mississippi	80.3	+4.3	2 stations	102	[1] 4	Batesville	49	25	2.13	−.94	Holly Springs	10.69	2 stations	T
Missouri	73.6	+4.4	Nevada	109	6	Kirksville	37	25	8.62	+4.44	Dean	14.31	Jackson	3.45
Montana	56.6	+1.9	Ballantine	101	2	2 stations	11	15	.95	−.40	Babb (near)	3.03	Scobey	T
Nebraska	67.4	+3.3	Nebraska City	105	11	Harrison	22	27	1.78	−.28	Auburn	7.78	Brewster	T
Nevada	62.2	+1.2	Logandale	109	1	2 stations	17	[1] 15	.29	−.12	Goldconda	1.47	6 stations	.00
New England	60.3	.0	Turners Falls, Mass.	93	8	Chelsa, Vt.	22	30	3.27	−.47	Provincetown, Mass.	8.20	Cavendish, Vt.	.82
New Jersey	66.9	+1.0	Flemington	94	12	Charlottesburg	28	26	4.33	+.77	Lakewood	6.90	Belvidere	1.25
New Mexico	62.9	−1.5	Pearl (near)	102	2	2 stations	10	28	2.78	+1.14	Mayhill Ranger Station.	7.57	Gage	.31
New York	62.1	+.8	2 stations	93	[1] 16	Indian Lake	18	30	3.19	−.23	South Edwards	6.70	Woodhull	.19
North Carolina	72.5	+1.4	Willard	99	13	Boone	33	26	4.77	+.74	Southport	13.10	Enfield	.84
North Dakota	60.3	+4.0	Berthold Agency	112	5	Howard	12	30	1.15	−.51	Cavalier	4.12	Amenia	.00
Ohio	69.3	+3.6	Gallipolis (near)	100	[1] 14	Holgate	32	25	3.18	+.19	Tippecanoe City	6.73	McConnelsville	.86
Oklahoma	76.6	+2.4	3 stations	108	[1] 1	Boise City	31	28	7.85	+4.67	Grove	15.45	Kenton	2.02
Oregon	57.2	−.4	Prairie City	100	20	Seneca	7	15	.83	−.37	Zigzag	3.54	Harper	T
Pennsylvania	66.5	+2.2	Claysville	96	15	Brookville	28	[1] 3	2.17	−1.23	Mount Lebanon	5.33	York Haven	.28
South Carolina	75.9	+1.4	Kingstree	101	19	Long Creek (near)	39	26	4.51	+.39	Clemson College	11.10	Ferguson	1.56
South Dakota	65.4	+3.9	Gannvalley	104	21	Camp Crook	15	30	.74	−.77	Vermillion	6.06	Onaka	.12
Tennessee	75.4	+3.9	2 stations	103	[1] 4	Madisonville	45	28	3.10	+.03	Bolivar	7.62	New River	.76
Texas	77.9	+.6	4 stations	107	[1] 1	2 stations	31	29	7.04	+4.15	San Angelo	27.65	Lufkin	.97
Utah	59.3	−1.3	St. George	100	[1] 1	do	14	28	.54	−.45	Yellow Stone Ranger Station.	2.10	4 stations	.00
Virginia	70.4	+1.7	2 stations	98	[1] 9	Woodstock	35	26	3.30	+.16	Diamond Springs	5.99	Riverton	.56
Washington	58.3	+.1	do	96	[1] 6	Northport	21	14	1.39	−.34	Cedar Lake	6.87	Bickleton	T
West Virginia	69.4	+2.9	do	99	14	Bayard	25	25	1.82	−1.11	Wellsburg	3.96	2 stations	.68
Wisconsin	62.9	+2.6	Blair	98	7	2 stations	25	29	3.48	−.17	Beloit	8.20	Plum Island	.72
Wyoming	54.5	+.3	Lagrange	97	13	Dome Lake	7	27	.70	−.44	Fort Laramie (near)	3.32	2 stations	T
Alaska (August)	54.8	+2.1	Richardson	89	8	Flat	24	27	3.07	−.46	Little Port Walter	13.37	Kotzebue	.15
Hawaii	75.0	+.4	Kaanapali	94	18	Kanalohuluhulu	50	[1] 9	7.13	+1.08	Pilhonua	31.00	Reservoir No. 8	.08
Puerto Rico	77.9	−.4	Utuado	100	17	Guineo Reservoir	44	9	9.93	+.89	La Mina (El Yunque).	29.12	Central San Francisco.	2.15

[1] Other dates also.

TABLE 1.—*Climatological data for Weather Bureau stations, September 1936*

[Compiled by Annie E. Small, by official authority, U. S. Weather Bureau]

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours.	Pressure: Sea level, reduced to mean of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: M'inimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	° *F.*	° *F.*	°*F.*		°*F.*	°*F.*		°*F.*	°*F.*	°*F.*	°*F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
New England							**61.0**	**+0.2**										**80**	**3.65**	**+0.5**										**6.1**		
Eastport	76	67	85	30.00	30.08	+0.05	54.8	−1.0	70	17	61	36	30	48	21	52	51	88	3.13	+0.4	13	6,853	sw.	28	w.	29	6	9	15	6.8	0.0	0.0
Greenville, Maine	1,070	6	40	28.92	30.08	------	54.2	------	78	23	63	27	30	46	35	----	----	----	3.36	------	14	3,438	se.	20	----	25	10	7	13	----	.0	.0
Portland, Maine	103	82	117	29.98	30.10	+.05	59.4	−.2	88	8	66	39	26	52	26	53	48	72	2.02	−1.1	14	6,371	sw.	25	ne.	19	18	5	7	4.3	.0	.0
Concord	289	60	----	----	----	----	60.6	+1.3	86	8	71	30	26	50	35	----	----	----	1.77	−1.7	10	----	ne.	----	----	----	10	16	4	----	.0	.0
Burlington	403	11	48	29.64	30.08	+.02	58.8	−1.5	84	8	68	30	30	49	31	54	51	77	2.77	−.7	12	6,899	s.	29	s.	24	4	19	7	5.9	.0	.0
Northfield	876	12	60	29.16	30.11	+.05	56.4	+.3	84	23	69	23	30	43	37	52	50	86	2.93	−.1	10	5,198	s.	24	s.	24	3	13	14	6.8	.0	.0
Boston [1]	29	31	50	30.06	30.09	+.02	62.6	−.6	90	8	70	41	26	55	25	57	54	78	3.79	+.6	11	7,074	sw.	39	n.	19	4	15	11	6.3	.0	.0
Nantucket	12	14	90	30.08	30.09	+.01	62.8	.0	78	17	68	47	26	57	17	59	56	82	4.15	+1.7	8	10,051	sw.	45	n.	19	5	8	17	6.7	.0	.0
Block Island	26	11	46	30.06	30.09	+.01	63.4	.0	81	9	68	49	26	59	16	60	58	86	5.07	+2.4	8	10,385	sw.	58	n.	19	6	11	13	6.4	.0	.0
Providence	160	215	251	29.93	30.10	+.03	63.4	+.2	89	8	72	39	26	55	25	57	54	76	5.29	+2.1	10	7,217	sw.	38	nw.	19	8	12	10	5.7	.0	.0
Hartford	159	70	104	29.93	30.10	+.03	64.2	+2.5	90	8	73	38	26	56	27	----	----	----	3.87	+.4	13	5,694	s.	27	n.	19	8	10	12	5.9	.0	.0
New Haven	106	74	153	29.99	30.10	+.03	64.8	+1.3	88	8	72	41	26	58	21	59	56	76	5.40	+1.9	9	6,779	n.	37	n.	18	6	11	13	6.6	.0	.0
Middle Atlantic States							**68.8**	**+1.9**										**77**	**3.45**	**+0.3**										**5.6**		
Albany	97	97	112	30.00	30.10	+.03	63.4	+.3	87	8	73	37	26	54	29	57	54	77	1.34	−1.8	10	5,643	s.	24	s.	24	11	9	10	5.5	.0	.0
Binghamton	871	57	79	29.18	30.11	+.04	63.5	+2.2	91	23	75	33	26	52	41	----	----	----	2.49	−.6	9	3,954	ne.	17	nw.	24	8	16	6	6.6	.0	.0
New York	314	415	454	29.76	30.09	+.01	67.1	+.3	87	9	73	50	26	61	20	61	58	77	5.07	+1.7	11	9,101	se.	50	n.	19	11	8	11	5.7	.0	.0
Harrisburg	374	94	104	29.69	30.08	.00	67.9	+2.1	89	8	77	42	26	59	28	61	57	72	2.45	−.6	9	4,901	ne.	24	w.	8	10	7	13	6.0	.0	.0
Philadelphia	114	174	367	29.98	30.10	+.02	69.5	+1.5	91	9	78	47	26	61	23	62	59	75	3.72	+.6	10	8,800	sw.	42	n.	18	10	8	12	5.5	0	0
Reading	323	283	306	29.74	30.09	------	67.8	+1.5	88	8	76	41	26	60	27	60	57	74	1.02	−2.2	9	7,275	se.	43	ne.	18	11	8	11	5.6	0	0
Scranton	805	72	104	29.24	30.10	+.03	65.4	+2.5	89	23	76	35	26	55	36	57	54	72	1.70	−1.5	7	4,377	n.	20	nw.	28	8	12	10	5.6	.0	.0
Atlantic City	52	37	172	30.03	30.08	+.01	68.1	+1.3	80	9	73	51	25	63	19	64	61	82	5.74	+3.1	9	11,417	s.	73	ne.	18	7	8	15	6.3	.0	.0
Sandy Hook	22	10	55	30.06	30.09	------	67.8	+.3	87	12	73	50	29	62	18	62	60	80	5.78	+2.4	9	9,783	s.	60	n.	18	9	11	10	5.4	.0	.0
Trenton	190	88	106	29.89	30.09	------	67.6	+.7	90	9	76	44	26	59	25	61	58	77	4.30	+.7	9	6,573	s.	33	n.	18	10	9	11	5.9	.0	.0
Baltimore	123	100	215	29.96	30.08	.00	71.4	+2.9	92	9	79	49	26	64	25	63	60	71	2.16	−1.2	8	7,239	s.	38	ne.	18	12	6	12	5.4	.0	.0
Washington	112	62	85	29.96	30.08	.00	71.4	+3.3	93	12	80	47	26	63	28	64	60	74	1.98	−1.3	8	4,460	s.	24	ne.	18	13	5	12	5.4	.0	.0
Cape Henry	18	8	54	30.04	30.06	------	73.5	+1.7	93	12	79	59	1	68	23	68	66	81	4.52	+1.7	7	9,340	e.	75	n.	18	10	11	9	5.1	.0	.0
Lynchburg	686	5	----	29.36	30.10	+.02	71.6	+2.6	96	13	84	38	26	59	38	----	----	----	4.64	+1.3	10	----	n.	----	----	----	3	22	5	----	.0	.0
Norfolk	91	80	125	29.98	30.08	+.02	73.6	+2.0	91	9	81	59	26	66	22	67	65	81	4.95	+1.7	7	7,155	e.	56	nw.	18	9	6	15	6.2	.0	.0
Richmond	144	11	52	29.94	30.09	+.02	73.6	+3.1	95	13	85	47	26	63	30	65	62	77	1.43	−1.8	8	5,445	sw.	32	n.	18	14	9	7	4.5	.0	.0
Wytheville	2,304	49	55	27.74	30.06	−.01	66.8	+3.2	86	12	78	38	26	56	32	60	58	80	53.8	+2.1	8	3,278	e.	16	n.	17	12	9	9	5.0	.0	.0
South Atlantic States							**76.3**	**+3.3**										**81**	**4.63**	**+0.4**										**5.3**		
Ashville	2,253	89	104	27.78	30.08	+.01	70.2	+5.2	89	12	81	46	26	60	31	63	61	82	5.30	+2.3	9	4,540	se.	23	se.	5	8	12	10	5.8	.0	.0
Charlotte	779	63	86	29.25	30.08	+.01	74.4	+2.9	92	13	83	48	26	65	25	67	64	76	5.46	+2.5	8	4,399	ne.	18	nw.	20	10	11	9	5.1	.0	.0
Greensboro	886	6	56	29.14	30.08	------	71.2	------	92	13	82	43	26	60	32	64	63	84	5.46	------	8	4,919	ne.	23	ne.	17	13	8	9	4.8	.0	.0
Hatteras	11	5	50	30.03	30.04	−.02	75.9	+1.4	87	13	81	63	25	71	16	71	68	80	5.97	+1.4	10	8,599	ne.	80	nw.	18	9	12	9	5.2	.0	.0
Raleigh	376	103	146	29.66	30.06	−.01	74.0	+2.9	94	13	84	48	26	64	24	67	65	79	6.49	+2.9	9	5,669	sw.	31	nw.	9	14	9	7	4.3	.0	.0
Wilmington	72	73	107	29.99	30.06	+.01	76.4	+3.3	90	13	84	58	26	68	23	71	69	84	4.25	−.3	11	5,506	ne.	27	nw.	18	10	11	9	5.6	.0	.0
Charleston	48	11	92	29.99	30.04	.00	78.8	+2.2	92	3	85	61	26	73	20	73	71	80	2.47	−2.1	10	7,033	ne.	27	ne.	5	4	15	11	6.2	.0	.0
Columbia, S. C	347	70	91	29.69	30.06	+.01	77.0	+2.5	92	19	86	55	26	68	23	69	66	77	2.09	−1.4	9	5,290	ne.	22	ne.	9	12	13	5	4.4	.0	.0
Greenville, S. C	1,039	139	----	----	----	----	74.4	+3.8	92	14	84	51	26	65	25	----	----	----	10.34	+6.7	8	----	ne.	----	----	----	14	8	8	----	.0	.0
Augusta	182	62	77	29.84	30.03	−.02	78.2	+2.9	96	19	87	59	1	69	25	70	68	80	1.92	−1.4	8	3,842	ne.	15	ne.	20	7	13	10	5.7	.0	.0
Savannah	65	73	152	29.96	30.04	+.01	80.0	+3.8	95	19	88	65	1	72	23	72	71	83	5.05	−.4	14	6,414	s.	26	nw.	24	4	16	10	5.9	.0	.0
Jacksonville	43	86	110	29.97	30.02	+.02	80.4	+2.1	93	19	88	70	26	73	21	73	71	81	1.61	−5.7	12	5,029	e.	20	e.	15	7	15	8	5.7	.0	.0
Florida Peninsula							**82.1**	**+1.3**										**79**	**4.84**	**−2.3**										**5.4**		
Key West	22	10	64	29.93	29.95	+.01	83.0	+.8	92	2	89	73	18	77	17	76	75	79	5.19	−1.5	13	5,203	e.	24	se.	6	9	12	9	5.3	.0	.0
Miami	25	124	168	29.95	29.98	+.01	81.8	+1.7	90	3	87	72	21	76	16	76	73	76	4.65	−3.7	17	5,242	e.	24	s.	25	6	15	9	5.8	.0	.0
Tampa	35	88	197	29.96	29.99	+.02	81.4	+1.5	93	13	90	70	17	73	21	74	72	82	4.68	−1.7	14	6,601	e.	32	e.	6	3	23	4	5.2	.0	.0
Titusville	43	5	36	29.94	29.99	------	80.0	------	93	4	89	68	18	71	24	----	----	----	2.11	------	9	------	e.	----	----	----	7	18	5	----	.0	.0
East Gulf States							**79.4**	**+5.3**										**79**	**2.94**	**−1.2**										**5.0**		
Atlanta [1]	976	5	53	29.03	30.03	−.02	76.0	+3.6	93	20	86	56	25	66	28	68	66	80	5.44	+2.4	8	4,438	ne.	25	nw.	29	3	17	10	6.2	.0	.0
Macon	370	79	87	29.64	30.03	.00	77.8	+3.0	94	19	87	59	1	68	26	71	70	83	1.40	−1.8	7	4,020	ne.	17	s.	29	4	19	7	5.7	.0	.0
Thomasville	273	49	58	29.73	30.02	+.01	79.2	+2.4	94	3	89	61	2	69	29	72	71	86	5.39	+.5	14	------	----	----	----	----	6	17	7	----	.0	.0
Apalachicola	35	11	----	29.96	30.00	------	80.7	+2.2	91	24	87	70	27	74	16	75	75	80	2.83	−5.1	8	----	ne.	----	----	----	9	15	6	5.2	.0	.0
Pensacola	56	149	185	29.94	30.00	+.01	80.2	+2.2	91	10	86	71	1	75	16	74	71	79	2.25	−3.1	9	7,347	ne.	27	nw.	9	14	15	1	4.0	.0	.0
Anniston	741	9	----	----	----	----	76.8	+5.5	93	19	86	56	1	67	30	----	----	----	3.25	−.4	7	----	se.	----	----	----	8	17	5	----	.0	.0
Birmingham	700	11	48	29.27	30.02	−.01	78.4	+3.6	95	19	89	56	25	68	27	69	66	77	2.70	−.7	9	4,378	e.	28	e.	21	10	13	7	5.0	.0	.0
Mobile	57	86	105	29.93	29.99	−.01	81.2	+3.1	93	22	89	63	1	73	25	73	71	79	2.18	−2.8	8	4,471	s.	17	n.	24	7	19	4	5.3	.0	.0
Montgomery	218	92	105	29.78	30.02	.00	79.6	+3.3	94	20	89	63	1	70	23	71	68	78	1.86	−1.1	9	4,273	e.	19	ne.	4	13	14	3	4.3	.0	.0
Meridian	375	67	92	29.61	29.99	−.03	79.8	+5.3	96	22	90	59	1	69	31	70	68	76	1.17	−1.8	8	3,670	e.	17	sw.	22	13	14	3	3.9	.0	.0
Vicksburg	247	65	73	29.74	29.99	−.03	80.7	+4.4	95	5	90	59	30	71	24	71	68	76	.04	−2.8	2	4,775	se.	15	se.	8	7	12	11	5.8	.0	.0
New Orleans	53	76	84	29.93	29.98	.00	82.7	+3.5	94	5	90	73	30	76	17	74	72	78	6.75	+1.7	12	3,771	se.	16	e.	16	11	14	5	4.8	.0	.0
West Gulf States							**79.9**	**+2.8**										**76**	**5.46**	**+1.8**										**5.5**		
Shreveport	249	92	227	29.70	29.96	−.04	82.2	+5.3	101	5	92	57	30	73	23	71	68	70	.84	−2.0	4	7,303	s.	28	e.	10	12	12	6	4.6	.0	.0
Bentonville	1,303	12	38	28.62	29.96	−.06	76.0	+7.1	100	6	86	47	30	66	31	----	----	----	10.32	+6.5	13	4,554	s.	23	nw.	23	7	10	13	----	.0	.0
Fort Smith	457	79	94	29.47	29.94	−.07	79.8	+5.8	103	5	89	51	30	70	31	68	63	66	8.08	+5.1	11	5,673	e.	31	nw.	9	6	13	11	6.1	.0	.0
Little Rock	357	94	102	29.60	29.97	−.06	79.4	+5.3	98	5	89	56	30	70	26	70	67	73	1.92	−1.2	7	5,763	e.	25	n.	23	11	10	9	5.6	.0	.0
Austin	605	136	148	29.30	29.93	------	79.8	+1.5	98	6	89	56	28	71	24	71	69	78	5.22	+1.8	10	5,530	se.	29	s.	16	10	12	8	5.1	.0	.0
Brownsville	57	88	96	29.82	29.88	------	80.1	−.5	91	5	86	60	30	74	18	74	73	87	8.15	+2.6	14	7,039	se.	31	s.	26	5	18	7	5.9	.0	.0
Corpus Christi	20	11	78	29.89	29.91	−.04	80.8	+1.1	90	3	86	61	29	76	22	75	73	81	3.93	−.6	15	7,783	s.	35	e.	13	9	10	11	5.9	.0	.0
Dallas	512	220	227	29.39	29.92	------	79.6	------	99	6	88	51	29	71	22	69	66	71	10.01	+7.3	7	7,681	se.	29	se.	25	7	14	9	5.5	.0	.0
Forth Worth	679	92	110	29.24	29.94	−.05	79.8	+2.9	101	6	88	51	29	71	25	----	----	----	7.30	+4.8	9	7,048	s.	28	s.	15	14	6	10	4.4	.0	.0
Galveston	54	106	114	29.89	29.95	−.03	81.6	+1.5	93	5	86	63	29	77	16	75	73	78	4.10	−1.5	11	8,169	s.	33	se.	14	12	11	7	5.2	.0	.0
Houston	138	292	314	29.81	29.95	------	80.2	+1.2	96	5	88	58	29	73	25	----	----	----	3.56	−.5	13	7,883	s.	34	se.	13	4	17	9	6.0	.0	.0
Palestine	510	64	72	29.44	29.96	−.03	79.5	+2.5	97	5	89	52	30	70	30	71	68	78	1.95	−1.0	8	5,323	s.	26	s.	15	10	15	5	4.8	.0	----
Port Arthur	34	58	66	29.92	29.96	------	81.7	------	96	5	88	59	30	75	22	75	73	81	7.26	+2.4	16	5,557	s.	25	s.	13	7	18	5	5.4	.0	.0
San Antonio	693	242	301	29.20	29.91	−.05	79.2	+.2	95	6	88	53	28	71	22	71	68	77	4.07	+1.0	11	7,860	se.	31	se.	14	1	18	11	6.6	.0	.0

[1] Observations taken at airport.

TABLE 1.—*Climatological data for Weather Bureau stations, September 1936*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station, reduced to mean of 24 hours.	Pressure: Sea level, reduced to means of 24 hours.	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
Ohio Valley and Tennessee	*Ft.*	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	*° F.*	*° F.*	*°F.*		*°F.*	*° F.*		*°F.*	*° F.*	*° F.*	*° F.*	*%*	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
							72.8	+4.1										72	3.24	+0.2										5.1		
Chattanooga	762	71	214	29.24	30.04	−0.02	77.6	+5.4	95	19	88	58	26	67	27	68	64	70	1.73	−1.4	8	4,532	se.	24	w.	9	13	12	5	5.0	0.0	0.0
Knoxville	995	66	84	29.01	30.04	−.02	76.1	+5.5	93	22	87	53	27	66	33	67	64	74	2.13	−.6	6	3,401	e.	17	nw.	24	18	7	5	3.7	.0	.0
Memphis	399	78	86	29.57	29.98	−.05	77.8	+4.2	95	11	86	55	25	70	23	69	66	73	6.04	+3.2	4	4,767	e.	24	nw.	23	10	12	8	5.3	.0	.0
Nashville	546	168	188	29.46	30.03	−.03	76.0	+4.2	94	8	86	53	26	66	28	67	63	71	1.86	−1.6	8	5,356	s.	30	se.	22	9	13	8	5.6	.0	.0
Lexington	989	6	.....	.....	.....	.....	73.8	+5.3	101	14	86	44	25	61	35	.....	.....	.....	2.55	−.5	6	.....	se.	.....	.....	.....	16	10	4	.....	.0	.0
Louisville	525	188	234	29.46	30.04	−.02	73.9	+3.4	94	14	83	48	25	65	27	65	60	69	3.50	+.7	10	6,763	s.	26	n.	24	11	10	9	5.3	.0	.0
Evansville	431	76	116	29.55	30.01	−.05	75.3	+4.6	97	12	85	49	25	66	30	66	62	69	2.15	−1.2	10	6,011	s.	29	s.	2	11	11	8	5.4	.0	.0
Indianapolis	822	194	230	29.16	30.03	−.03	70.9	+4.0	95	14	80	44	25	62	28	62	57	67	4.30	+.9	10	7,298	s.	25	n.	24	11	8	11	5.6	.0	.0
Terre Haute	575	63	149	29.39	30.00	.....	72.5	.....	98	13	82	45	25	63	28	63	59	70	5.00	+1.4	11	6,496	sw.	26	n.	24	12	9	9	5.2	.0	.0
Cincinnati	627	11	51	29.37	30.04	−.03	71.4	+4.3	94	15	82	44	25	61	33	62	59	73	3.71	+1.1	11	4,701	s.	21	sw.	16	11	11	8	4.9	.0	.0
Columbus	822	90	210	29.18	30.05	−.02	70.8	+4.3	95	15	81	45	25	60	28	61	57	69	3.29	+.7	10	6,144	s.	29	sw.	27	14	11	5	4.4	.0	.0
Dayton	900	58	153	29.06	30.03	.....	71.0	+4.4	94	14	81	45	25	61	27	.....	.....	.....	3.94	+1.0	8	5,756	sw.	32	sw.	23	13	9	8	4.9	.0	.0
Elkins	1,947	59	78	28.09	30.11	+.03	66.2	+3.2	90	13	79	36	26	54	42	59	57	84	1.55	−1.6	8	3,019	se.	18	s.	28	9	9	12	6.2	.0	.0
Parkersburg	637	77	84	29.43	30.08	.00	71.6	+4.3	95	14	83	44	25	60	34	62	58	71	1.98	−.8	9	4,023	se.	20	nw.	24	15	9	6	4.4	.0	.0
Pittsburgh [1]	842	164	410	28.72	30.06	−.02	67.8	+1.4	91	23	78	45	25	58	30	59	55	72	4.93	+2.4	8	6,776	s.	34	nw.	12	10	13	7	5.2	.0	.0
Lower Lake Region							65.4	+2.5										73	3.74	+0.8										5.3		
Buffalo	768	243	280	29.24	30.06	.00	63.4	+1.0	86	23	71	37	30	56	29	58	54	74	2.91	.0	10	9,412	sw.	50	sw.	15	11	10	9	5.1	.0	.0
Canton	448	10	61	29.59	30.06	.....	60.2	+.9	86	23	71	30	30	49	36	54	51	76	5.08	+1.7	13	5,177	sw.	21	e.	13	5	18	7	5.8	.0	.0
Ithaca	836	77	100	29.19	30.09	.....	63.2	+1.6	89	23	75	31	30	52	37	56	53	73	1.66	−1.4	9	6,322	s.	27	se.	30	11	5	14	5.7	.0	.0
Oswego	335	71	85	29.70	30.07	+.01	62.4	+1.2	89	23	70	36	26	54	32	57	54	77	4.08	+1.4	9	6,035	s.	22	n.	28	9	10	11	5.8	.0	.0
Rochester	523	86	102	29.52	30.08	+.02	64.8	+2.4	91	15	74	39	30	56	29	57	52	68	3.16	+.7	11	5,378	sw.	22	sw.	24	12	9	9	5.1	.0	.0
Syracuse	596	65	79	29.45	30.10	+.03	64.2	+2.4	91	23	74	36	30	54	32	.....	.....	.....	3.01	+.3	13	5,037	s.	21	nw.	24	8	11	11	5.8	.0	.0
Erie	714	130	166	29.30	30.06	.00	66.8	+3.2	92	15	75	39	30	59	26	59	56	72	1.52	−1.9	5	9,164	s.	32	se.	30	17	7	6	4.1	.0	.0
Cleveland	762	267	318	29.24	30.06	.00	68.0	+4.1	90	15	76	41	30	60	26	60	55	68	2.75	−.6	11	9,873	s.	47	nw.	16	11	9	10	5.2	.0	.0
Sandusky	629	5	67	29.38	30.06	.00	68.8	+3.5	95	11	78	45	30	60	32	.....	.....	.....	3.28	+.3	11	5,906	sw.	26	sw.	23	10	8	12	5.5	.0	.0
Toledo	628	79	87	29.39	30.06	.00	67.8	+3.4	92	11	77	39	25	59	28	60	57	74	6.70	+3.9	11	6,087	e.	28	n.	30	11	11	8	4.8	.0	.0
Fort Wayne	857	69	84	29.13	30.05	.....	68.4	+3.5	91	11	78	41	25	59	28	60	57	73	4.82	+1.8	12	5,837	ne.	23	w.	11	10	11	9	5.2	.0	.0
Detroit [1]	626	5	78	29.38	30.06	.00	66.2	+2.7	92	15	76	37	25	56	32	59	56	75	5.90	+3.0	15	6,188	ne.	26	nw.	24	9	8	13	5.4	.0	.0
Upper Lake Region							62.1	+2.6										79	4.40	+1.4										5.6		
Alpena	609	13	89	29.40	30.06	+.03	59.4	+1.8	93	15	68	32	25	50	37	55	52	81	3.59	+.6	12	7,066	nw.	28	se.	25	9	10	11	5.7	.0	.0
Escanaba	612	54	60	29.36	30.02	+.01	59.2	+2.1	83	23	67	35	28	51	35	55	52	81	2.60	−.7	11	6,970	s.	30	n.	23	7	13	10	5.7	.0	.0
Grand Rapids	707	70	244	29.28	30.04	−.01	65.8	+3.1	91	15	76	40	25	56	30	60	57	81	7.67	+4.1	14	6,813	e.	36	ne.	23	10	9	11	5.4	.0	.0
Lansing	878	5	90	29.11	30.05	.....	62.9	+1.5	86	15	73	34	25	53	30	58	56	84	7.76	+4.8	14	5,059	e.	20	sw.	23	9	12	9	5.1	.0	.0
Ludington	637	5	54	29.34	30.03	.....	63.2	+3.9	84	14	71	39	28	55	25	58	.....	.....	4.18	+.9	12	.....	e.	.....	.....	.....	15	9	6	.....	.0	.0
Marquette	734	77	111	29.20	30.01	+.01	59.0	+1.5	86	22	67	39	27	51	37	53	50	78	3.05	−.2	8	6,791	s.	30	sw.	22	7	12	11	6.1	.0	.0
Sault Sainte Marie	614	11	52	29.36	30.05	+.03	57.0	+1.5	84	23	66	31	25	48	34	52	50	83	5.30	+1.1	12	4,768	se.	27	sw.	23	7	10	13	6.5	.0	.0
Chicago	673	7	131	29.31	30.03	−.01	68.2	+3.0	91	14	75	46	25	61	25	61	58	77	8.97	+5.8	14	6,697	s.	35	nw.	11	13	5	12	5.2	.0	.0
Green Bay	617	109	141	29.35	30.01	−.01	63.8	+3.4	90	14	73	40	28	54	34	57	54	76	2.23	−1.3	10	7,083	s.	26	w.	6	11	7	12	5.3	.0	.0
Milwaukee	681	97	221	29.29	30.02	−.01	66.0	+3.5	91	14	73	45	28	59	26	60	56	75	5.59	+2.3	15	8,565	sw.	34	n.	23	10	9	11	5.5	.0	.0
Duluth	1,133	5	47	28.75	29.96	−.02	58.8	+3.7	86	8	68	32	24	50	40	52	48	78	1.48	−1.8	6	8,182	ne.	39	nw.	23	9	11	10	5.8	.0	.0
North Dakota							60.5	+3.3										62	1.06	−0.5										4.6		
Moorhead, Minn	940	50	58	28.94	29.94	−.02	62.2	+4.0	101	22	75	31	29	49	50	52	46	64	.26	−2.0	6	6,411	s.	24	sw.	17	5	12	13	6.3	.0	.0
Bismarck	1,674	8	57	28.16	29.93	−.01	61.6	+3.5	95	22	75	31	27	48	41	51	43	60	1.66	+.4	5	6,705	nw.	34	se.	13	14	13	3	4.0	.0	.0
Devils Lake	1,478	11	44	28.38	29.94	.00	58.4	+2.5	92	22	71	26	30	46	38	50	45	70	1.85	+.2	7	6,673	s.	26	nw.	23	10	11	9	5.1	.0	.0
Grand Forks	833	12	67	.....	.....	.....	60.2	.....	96	22	73	26	29	48	44	51	.....	.....	1.27	.....	8	.....	nw.	29	se.	12	5	16	9	.....	.0	.0
Williston	1,878	42	50	27.96	29.92	−.01	59.9	+3.3	93	2	74	27	30	46	40	48	39	55	.46	−.6	5	5,987	n.	34	w.	5	20	8	2	2.9	T	.0
Upper Mississippi Valley							69.2	+3.9										76	6.30	+2.7										5.5		
Minneapolis	919	105	208	28.99	29.96	.....	66.7	+5.3	95	22	77	39	29	57	30	57	51	64	.78	−2.4	9	7,304	s.	30	se.	9	12	10	8	4.4	.0	.0
La Crosse	714	11	48	29.22	29.98	−.03	65.2	+3.0	91	14	75	41	28	55	31	59	56	81	5.35	+1.4	10	3,281	s.	15	s.	25	14	8	8	4.7	.0	.0
Madison	974	70	78	28.97	30.00	−.03	64.4	+2.0	89	14	72	44	28	57	24	59	56	79	4.60	+.9	10	5,556	s.	21	nw.	6	10	9	11	5.7	.0	.0
Charles City	1,015	10	51	28.92	29.99	−.01	64.9	+3.9	92	6	74	40	28	55	30	59	56	82	8.26	+4.6	9	4,571	se.	28	nw.	6	17	4	9	4.3	.0	.0
Davenport	606	66	161	29.35	30.00	−.03	69.2	+3.6	94	6	78	48	29	61	25	62	59	77	9.29	+5.7	14	6,222	ne.	32	ne.	11	7	9	14	6.2	.0	.0
Des Moines	861	5	99	29.07	29.96	−.06	69.5	+3.9	97	11	80	46	28	60	32	62	58	74	8.50	+4.8	14	6,176	se.	31	w.	11	6	15	9	5.8	.0	.0
Dubuque	699	60	79	29.26	30.00	−.03	66.3	+2.3	92	6	75	44	28	57	31	60	57	78	5.10	+1.1	15	3,756	s.	19	s.	1	10	9	11	5.7	.0	.0
Keokuk	614	64	78	29.33	29.98	−.05	71.6	+4.1	100	11	81	48	30	62	27	63	58	70	7.59	+3.8	13	5,311	e.	21	n.	16	8	8	14	6.3	.0	.0
Cairo	358	87	93	29.62	29.99	−.06	75.6	+4.1	94	12	84	52	25	67	27	68	65	78	3.57	+.7	9	5,486	s.	30	n.	9	9	8	16	6.3	.0	.0
Peoria	609	11	45	29.36	30.02	−.02	70.5	+6.2	96	6	80	47	25	61	28	63	60	79	10.58	+6.6	12	4,422	ne.	15	n.	16	13	5	12	5.2	.0	.0
Springfield, Ill	636	5	191	29.32	29.99	−.06	72.8	+5.2	98	11	82	46	25	63	28	64	60	74	6.06	+2.4	10	7,579	s.	29	nw.	11	8	12	10	6.0	.0	.0
St. Louis	568	179	303	29.38	29.98	−.06	74.2	+3.7	98	13	83	51	29	66	25	65	61	70	5.94	+2.5	11	8,018	sw.	33	sw.	23	12	6	12	5.7	.0	.0
Missouri Valley							71.1	+4.6										66	5.43	+2.1										4.8		
Columbia, Mo	784	6	84	29.14	29.96	−.07	72.9	+4.7	100	11	82	50	30	64	29	.....	.....	.....	10.21	+5.9	11	5,524	s.	26	se.	15	11	7	12	5.6	.0	.0
Kansas City [1]	750	32	45	29.15	29.94	−.08	73.6	+4.7	104	6	82	49	28	65	30	64	60	71	7.99	+3.4	16	6,462	s.	31	nw.	8	7	10	13	6.1	.0	.0
St. Joseph	967	11	49	28.93	29.94	.....	72.3	.....	102	6	82	48	27	63	31	63	59	72	8.14	+4.3	16	5,586	s.	32	nw.	8	13	5	12	5.4	.0	.0
Springfield, Mo	1,324	98	104	28.59	29.97	−.06	74.2	+5.3	97	6	83	48	30	65	27	74	60	71	7.29	+3.8	14	6,871	s.	28	sw.	1	9	13	8	5.2	.0	.0
Iola	984	11	50	28.91	29.93	−.06	75.8	+6.0	104	5	86	51	28	66	33	.....	.....	.....	7.77	+3.8	12	.....	se.	.....	.....	.....	7	13	10	.....	.0	.0
Topeka	987	65	87	.....	.....	.....	73.2	+4.5	105	6	84	49	28	63	35	.....	.....	.....	7.32	+3.5	15	6,289	s.	23	sw.	11	11	10	9	5.3	.0	.0
Lincoln	1,189	11	81	28.69	29.93	−.06	71.6	+5.2	101	10	82	44	17	61	36	61	55	67	3.38	+.4	6	7,176	s.	39	w.	8	13	9	8	4.7	.0	.0
Omaha [1]	982	31	44	28.91	29.94	−.06	70.0	+3.2	101	6	81	42	30	59	33	61	57	74	4.54	+1.3	9	7,077	s.	34	sw.	8	12	9	9	5.0	.0	.0
Valentine	2,598	47	54	27.29	29.98	+.02	65.2	+2.7	94	21	79	32	27	51	44	52	43	54	1.06	−.2	6	6,711	n.	26	n.	25	21	5	4	2.7	.0	.0
Sioux City	1,138	64	106	28.85	29.93	−.05	68.9	+5.5	95	14	80	37	30	58	40	59	53	65	2.07	−1.0	12	6,597	s.	35	s.	25	14	8	8	4.5	.0	.0
Huron	1,307	59	74	28.57	29.95	−.01	66.0	+4.7	99	22	79	32	27	53	47	54	46	57	.33	−1.2	5	6,845	se.	31	se.	13	18	10	2	3.0	.0	.0
Northern Slope							58.7	+1.9										59	0.78	−0.5										3.6		
Havre	2,505	11	67	27.35	29.96	+.02	58.4	+2.0	94	21	73	27	16	44	46	46	34	48	.14	−1.2	6	6,501	nw.	36	se.	12	14	11	5	4.2	.0	.0
Helena	4,124	85	111	25.85	30.01	+.04	56.4	−.2	87	21	69	29	16	44	40	45	34	51	.90	−.4	6	5,680	sw.	24	nw.	22	12	10	8	4.5	.0	.0
Missoula	3,263	80	91	.....	.....	.....	57.0	+1.6	89	21	71	30	16	43	44	.....	.....	.....	1.22	−.2	7	4,421	se.	35	e.	29	14	8	8	4.2	.0	.0
Kalispell	2,973	48	56	.....	30.00	+.04	54.3	+.8	85	21	68	28	16	41	45	.....	.....	60	1.04	−.2	7	4,607	w.	24	nw.	24	12	9	9	.....	.0	.0
Miles City	2,371	48	55	27.45	29.98	+.03	62.4	+1.2	94	2	76	33	30	49	42	49	36	45	.69	−.4	3	4,678	s.	27	n.	22	16	12	2	3.4	.0	.0
Rapid City	3,259	50	58	26.63	29.99	+.03	64.8	+4.4	94	22	77	35	27	52	38	50	37	41	.56	−.6	5	6,644	w.	25	n.	6	21	6	3	2.9	.0	.0
Cheyenne [1]	6,094	50	71	24.02	29.95	−.01	58.3	+1.3	85	9	74	28	26	43	50	44	34	50	1.14	−.1	5	7,835	nw.	39	n.	28	22	3	5	2.7	.7	.0
Lander	5,372	60	68	24.69	29.98	+0.02	56.6	+0.9	88	22	73	23	27	40	45	43	30	44	0.96	0.0	3	3,960	sw.	28	sw.	13	19	9	2	2.7	3.0	.0
Sheridan	3,790	10	47	26.12	29.99	.....	59.1	.....	92	12	76	27	27	42	52	46	35	52	.88	−.4	4	3,704	nw.	24	s.	2	18	10	2	3.0	.0	.0
Yellowstone Park	6,241	12	46	23.94	30.07	+.10	51.0	+.9	80	21	66	20	15	36	40	39	29	52	.69	−.5	8	5,568	sw.	37	sw.	2	14	10	6	4.3	2.4	.0
North Platte	2,821	11	51	27.06	29.94	−.03	67.9	+5.8	95	14	81	38	27	55	42	55	48	59	.35	−1.0	4	5,766	se.	27	ne.	25	16	9	5	3.7	.0	.0

[1] Observations taken at airport.

TABLE 1.—*Climatological data for Weather Bureau stations, September 1936*—Continued

District and station	Elevation of instruments: Barometer above sea level	Elevation of instruments: Thermometer above ground	Elevation of instruments: Anemometer above ground	Pressure: Station reduced to mean of 24 hours	Pressure: Sea level, reduced to means of 24 hours	Pressure: Departure from normal	Temperature of the air: Mean max. + mean min. ÷ 2	Temperature of the air: Departure from normal	Temperature of the air: Maximum	Temperature of the air: Date	Temperature of the air: Mean maximum	Temperature of the air: Minimum	Temperature of the air: Date	Temperature of the air: Mean minimum	Temperature of the air: Greatest daily range	Mean wet thermometer	Mean temperature of the dew-point	Mean relative humidity	Precipitation: Total	Precipitation: Departure from normal	Precipitation: Days with 0.01 inch, or more	Wind: Total movement	Wind: Prevailing direction	Wind: Maximum velocity: Miles per hour	Wind: Maximum velocity: Direction	Wind: Maximum velocity: Date	Clear days	Partly cloudy days	Cloudy days	Average cloudiness, tenths	Total snowfall	Snow, sleet, and ice on ground at end of month
	Ft.	*Ft.*	*Ft.*	*In.*	*In.*	*In.*	° *F.*	° *F.*	°*F.*		°*F.*	° *F.*		°*F.*	° *F.*	° *F.*	° *F.*	%	*In.*	*In.*		*Miles*								*0–10*	*In.*	*In.*
Middle Slope							**70.2**	**+2.2**										**61**	**4.06**	**+2.0**										**5.0**		
Denver	5,292	106	113	24.77	29.95	−0.01	63.8	+.9	88	5	76	30	27	52	46	49	37	45	2.89	+1.9	7	5,404	s.	36	n.	25	20	5	5	3.1	16.5	T
Pueblo	4,685	80	86	25.32	29.94	−.02	64.8	+.2	92	10	78	32	28	51	40	51	41	50	1.77	+1.0	8	4,770	e.	21	n.	25	16	9	5	3.9	6.6	0.0
Concordia	1,392	50	58	28.51	29.96	−.03	72.0	+3.7	100	10	82	44	30	62	31	61	56	67	4.56	+2.0	9	6,433	s.	22	sw.	14	10	11	9	4.9	.0	.0
Dodge City	2,509	10	86	27.39	29.95	−.03	70.5	+1.1	97	6	82	39	27	59	32	60	55	67	1.81	−.1	11	9,044	s.	35	se.	3	11	8	11	5.3	.0	.0
Wichita	1,358	85	93	28.52	29.92	−.08	74.2	+3.6	101	10	83	47	28	65	29	63	58	66	4.84	+1.8	13	7,939	sw.	29	sw.	8	6	9	15	6.6	.0	.0
Oklahoma City	1,214	10	47	28.67	29.92	−.07	76.2	+3.4	102	7	85	45	29	68	26	66	62	71	8.49	+5.4	14	6,619	s.	21	s.	1	8	7	15	6.5	.0	.0
Southern Slope							**73.6**	**+0.1**										**70**	**5.04**	**+2.5**										**5.7**		
Abilene	1,738	10	52	28.15	29.92	−.04	76.6	+1.3	100	2	86	46	30	68	27	66	62	71	7.32	+4.6	9	6,928	s.	27	s.	1	10	8	12	5.6	.0	.0
Amarillo	3,676	10	49	26.29	29.96	.00	69.2	−.1	95	2	79	36	27	59	32	60	55	71	4.74	+2.4	11	6,446	s.	21	n.	26	9	12	9	5.7	.0	.0
Del Rio	960	63	71	28.89	29.86	−.08	78.8	−.4	94	2	87	58	28	71	22	70	67	72	2.97	.0	10	6,719	se.	24	e.	13	2	11	17	7.0	.0	.0
Roswell	3,566	75	85	26.37	29.92	.00	69.8	−.5	94	2	81	33	28	59	32	60	55	68	5.15	+3.0	9	5,074	s.	23	nw.	13	12	11	7	4.4	.0	.0
Southern Plateau							**70.4**	**0.0**										**55**	**1.56**	**+0.8**										**2.9**		
El Paso	3,778	82	110	26.16	29.86	−.02	73.7	−.2	96	6	84	44	28	63	28	61	55	60	3.52	+2.3	8	5,328	e.	27	n.	27	20	6	4	3.3	.0	.0
Albuquerque	4,972	5	39	25.08	29.87	------	66.2	−1.7	92	1	79	35	27	53	35	54	47	60	2.05	+1.2	9	5,413	n.	35	w.	1	13	9	8	4.2	T	.0
Santa Fe	7,013	38	53	23.33	29.92	−.01	59.6	−1.3	83	9	71	28	28	49	31	50	44	67	3.33	+1.9	13	3,711	e.	23	se.	26	14	11	5	4.5	4.0	.0
Flagstaff	6,907	10	59	23.44	29.88	+.01	55.8	+.3	81	7	70	25	28	42	44	46	----	64	1.41	------	8	5,688	nw.	35	nw.	10	10	14	6	----	----	.0
Phoenix	1,108	10	107	28.64	29.77	−.04	83.6	+.9	107	7	97	53	28	70	36	64	51	38	.43	−.3	1	4,172	e.	35	nw.	24	22	5	3	2.1	.0	.0
Yuma	141	9	54	29.61	29.75	−.03	85.0	+1.3	109	7	100	54	28	70	43	66	54	42	.02	−.3	1	3,872	w.	25	n.	26	28	2	0	.6	.0	.0
Independence	3,957	5	26	25.93	29.90	------	68.6	+.6	95	9	86	40	28	51	42	48	----	----	T	−.1	0	-------	s.	----	------	----	28	1	1	----	.0	.0
Middle Plateau							**61.7**	**−0.4**										**37**	**0.41**	**−0.2**										**1.7**		
Reno	4,527	61	76	25.48	29.92	−.03	61.6	+1.1	89	23	78	35	15	45	42	46	32	41	.12	−.1	3	4,077	sw.	22	sw.	12	27	1	2	1.1	.0	.0
Tonopah	6,090	12	20	----	----	----	63.9	----	86	1	75	39	14	53	32	45	24	25	.10	------	1	-------	nw.	----	------	----	----	----	----	----	.0	.0
Winnemucca	4,344	18	56	25.63	29.98	+.05	58.7	−.5	91	21	78	27	28	39	51	44	29	40	.76	+.4	3	4,876	ne.	25	w.	12	26	1	3	1.4	.0	.0
Modena	5,473	10	43	24.62	29.88	−.04	59.6	−.4	88	1	77	29	29	42	45	44	28	36	.28	−.5	2	7,126	sw.	35	sw.	2	24	5	1	1.3	.0	.0
Salt Lake City [1]	4,240	32	46	25.72	29.92	−.03	61.9	−2.5	93	9	78	31	28	46	40	47	33	39	.16	−.8	5	7,005	se.	43	e.	26	23	6	1	2.0	.0	.0
Grand Junction	4,602	60	68	25.38	29.92	−.03	66.6	+.4	90	9	81	34	27	52	39	51	38	42	.72	−.2	4	4,580	se.	27	s.	13	20	6	4	2.7	.0	.0
Northern Plateau							**61.0**	**+0.6**										**45**	**0.57**	**−0.2**										**2.5**		
Baker	3,471	48	53	26.49	30.05	+.06	56.9	+.9	90	21	74	25	15	40	45	45	32	45	.33	−.4	6	4,295	n.	17	n.	25	22	3	5	2.4	T	.0
Boise	2,739	79	87	27.17	30.01	+.04	62.0	+.1	90	21	76	34	15	48	38	49	37	44	.07	−.5	1	3,492	nw.	23	nw.	1	21	6	3	1.9	.0	.0
Pocatello	4,477	60	68	25.49	29.97	+.01	59.5	−.7	87	21	75	28	16	44	43	44	29	37	.20	−.6	2	5,659	se.	30	sw.	25	22	6	2	1.7	.0	.0
Spokane	1,929	101	110	27.98	30.01	+.03	59.1	−.1	85	20	72	36	16	46	39	49	39	55	1.64	+.7	7	3,846	s.	24	s.	4	17	6	7	3.7	.0	.0
Walla Walla	991	57	65	28.94	30.00	.00	64.9	+1.1	90	21	77	40	16	52	36	52	40	44	.93	.0	4	3,444	s.	19	w.	14	20	5	5	2.7	.0	.0
Yakima	1,076	58	67	28.86	30.01	------	63.6	+2.5	90	21	78	37	13	49	42	51	40	46	.25	−.3	3	3,968	nw.	23	nw.	24	19	8	3	2.6	.0	.0
North Pacific Coast Region							**59.0**	**+0.6**										**72**	**1.10**	**−1.1**										**4.3**		
North Head	211	11	56	29.86	30.08	+.05	56.4	−.1	82	27	61	45	12	52	26	53	50	86	1.04	−2.0	5	7,890	nw.	35	s.	13	11	10	9	5.1	.0	.0
Seattle	125	90	321	29.92	30.05	+.04	59.6	+1.5	78	27	68	46	14	51	25	54	50	73	1.40	−.4	7	5,036	n.	29	s.	1	9	15	6	4.6	.0	.0
Tatoosh Island	86	10	54	29.98	30.08	+.07	52.8	−.2	66	28	57	46	15	49	18	51	49	90	1.45	−3.2	6	7,015	s.	34	e.	28	6	5	19	7.1	.0	.0
Medford	1,329	29	58	28.58	29.97	------	64.5	------	96	20	84	34	15	45	51	52	41	54	.35	−.2	3	-------	nw.	----	------	----	23	2	5	1.9	.0	.0
Portland, Oreg	153	68	106	29.87	30.03	.00	63.4	+1.7	88	28	73	44	15	54	33	56	50	66	1.41	−.6	5	4,648	nw.	18	ne.	26	14	11	5	3.8	.0	.0
Roseburg	510	45	76	29.46	30.01	−.01	62.8	−.1	94	27	78	39	16	48	50	54	45	61	.92	−.4	5	3,168	n.	17	n.	10	17	6	7	3.3	.0	.0
Middle Pacific Coast Region							**64.3**	**+2.3**										**57**	**0.02**	**−0.6**										**2.2**		
Eureka	62	73	89	29.90	29.97	−.04	56.0	+.1	83	26	62	45	13	50	33	52	49	83	.04	−1.0	1	4,010	sw.	24	n.	14	18	5	7	3.8	.0	.0
Redding	722	20	34	----	----	----	78.2	------	102	20	91	50	14	66	33	56	34	25	.04	−.8	2	6,821	nw.	27	nw.	1	23	5	2	1.5	.0	.0
Sacramento	69	92	115	29.76	29.83	−.06	74.0	+4.7	102	24	90	50	14	58	44	58	44	42	T	−.4	0	4,614	s.	27	nw.	26	28	2	0	.6	.0	.0
San Francisco	155	112	132	29.71	29.88	−.06	63.0	+2.1	91	7	71	51	20	55	32	56	52	78	T	−.4	0	6,703	w.	26	w.	1	19	11	0	2.8	.0	.0
South Pacific Coast Region							**71.6**	**+1.8**										**63**	**0.02**	**−0.1**										**1.8**		
Fresno	327	97	105	29.48	29.82	−.05	76.4	+3.0	105	9	92	52	14	60	38	58	44	38	.00	−.2	0	4,321	nw.	20	nw.	1	28	1	1	.5	.0	.0
Los Angeles	338	159	191	29.50	29.86	−.02	70.5	+1.5	88	29	80	58	14	61	27	61	57	70	.03	−.1	1	3,844	sw.	15	w.	7	21	8	1	2.2	.0	.0
San Diego	87	62	70	29.76	29.85	−.04	68.0	+.9	77	6	73	58	29	63	17	63	60	80	.04	.0	1	4,889	nw.	18	nw.	7	22	6	2	2.8	.0	.0
West Indies																																
San Juan, P. R	82	9	54	29.85	29.93	------	80.4	−.1	89	16	85	72	28	76	13	----	----	----	5.84	−.1	22	7,211	e.	31	e.	11	6	22	2	4.7	.0	.0
Panama Canal																																
Balboa Heights	118	6	92	------	[2] 29.83	+.01	79.4	−.4	90	16	85	72	26	73	17	----	----	[2] 89	8.62	+.5	17	3,330	nw.	27	n.	9	1	6	23	8.0	.0	.0
Cristobal	36	6	97	------	[2] 29.84	+.01	80.9	+.5	91	20	86	74	25	76	16	76	75	[2] 85	14.58	+2.1	23	3,830	se.	24	e.	25	1	10	19	7.9	.0	.0
Alaska																																
Fairbanks	454	11	37	[2] 29.43	[2] 29.95	------	42.5	------	62	16	54	23	15	32	32	39	33	70	.76	------	7	4,246	ne.	30	s.	26	6	7	17	6.9	T	.0
Juneau	80	96	116	[2] 29.89	[2] 29.98	------	55.0	------	67	28	55	34	10	45	24	47	43	79	12.34	------	22	4,829	s.	29	se.	19	6	1	23	7.9	T	.0
Hawaiian Islands		•																														
Honolulu	38	86	100	[3] 29.93	[3] 29.97	------	78.4	+.2	84	26	83	72	15	74	11	71	68	72	1.11	−.2	14	6,279	e.	25	e.	14	9	19	2	4.7	.0	.0

[1] Observations taken at airport. [2] Observations taken bihourly. [3] Pressure not reduced to mean of 24 hours.

TABLE 2.—*Data furnished by the Canadian Meteorological Service, September 1936*

Stations	Altitude above mean sea level, Jan. 1, 1919	Pressure			Temperature of the air						Precipitation		
		Station reduced to mean of 24 hours	Sea level reduced to mean of 24 hours	Departure from normal	Mean max.+mean min.÷2	Departure from normal	Mean maximum	Mean minimum	Highest	Lowest	Total	Departure from normal	Total snowfall
	Feet	*In.*	*In.*	*In.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	°*F.*	*In.*	*In.*	*In.*
Cape Race, Newfoundland	99				51.7		57.8	45.7	64	35	5.32		0.0
Sydney, Cape Breton Island	48	29.95	30.00	−0.01	56.5	0.0	64.7	48.3	75	39	3.35	+0.07	.0
Halifax, Nova Scotia	88	29.80	29.90	−.14	57.7	+.1	63.5	51.8	71	39	8.18	+4.47	.0
Yarmouth, Nova Scotia	65	29.96	30.03	−.02	56.2	+.1	62.9	49.6	72	37	5.91	+2.30	.0
Charlottetown, Prince Edward Island	38	29.94	29.98	−.03	56.6	−.7	63.0	50.1	72	38	4.89	+1.49	.0
Chatham, New Brunswick	28	29.92	29.95	−.05	55.1	−.3	65.0	45.2	80	27	1.49	−1.22	.0
Father Point, Quebec	20												
Quebec, Quebec	296	29.68	30.00	−.01	57.2	+2.1	65.1	49.3	83	33	4.05	+.38	.0
Doucet, Quebec	1,236				49.4		60.7	38.1	85	18	4.37		.0
Montreal, Quebec	187												
Ottawa, Ontario	236	29.81	30.07	+.03	58.2	+.8	69.1	47.3	84	29	4.25	+1.56	.0
Kingston, Ontario	285	29.76	30.07	+.03	61.2	+1.2	68.9	53.4	82	33	4.49	+1.69	.0
Toronto, Ontario	379	29.66	30.06	.00	62.7	+3.7	71.5	53.8	87	37	2.90	−.35	.0
Cochrane, Ontario	930				52.3		61.3	43.3	86	26	2.91		T
White River, Ontario	1,244	28.69	30.00	+.02	51.1	+.8	62.5	39.7	78	20	4.90	+2.13	.2
London, Ontario	808				62.0		72.9	51.1	89	33	5.43		.0
Southampton, Ontario	656	29.36	30.07	+.02	60.0	+2.5	69.7	50.2	90	32	2.83	−.11	.0
Parry Sound, Ontario	688	29.36	30.04	+.01	59.1	+3.1	68.9	49.3	87	31	4.46	+.79	.0
Port Arthur, Ontario	644												
Winnipeg, Manitoba	760	29.10	29.92	−.02	56.6	+4.1	67.6	45.5	90	24	2.05	+.02	.0
Minnedosa, Manitoba	1,690												
Le Pas, Manitoba	860				48.1		57.3	38.9	78	27	3.68		.0
Qu'Appelle, Saskatchewan	2,115	27.66	29.89	−.03	53.2	+2.1	67.8	38.5	92	23	.61	−.72	.0
Moose Jaw, Saskatchewan	1,759				56.4		70.3	42.6	90	27	.64		.0
Swift Current, Saskatchewan	2,392	27.39	29.90	−.02	54.8	+1.7	67.9	41.8	87	24	.74	−.48	.0
Medicine Hat, Alberta	2,365				56.3	+1.3	68.3	44.3	88	32	.55	−.63	.0
Calgary, Alberta	3,540	26.34	30.01	+.09	49.7	−.1	61.0	38.4	80	25	1.13	−.23	.7
Banff, Alberta	4,521												
Prince Albert, Saskatchewan	1,450	28.40	29.97	+.07	49.6	+1.2	58.9	40.4	80	29	2.51	+1.23	.0
Battleford, Saskatchewan	1,592	28.21	29.94	+.04	51.0	−.8	62.9	39.2	85	24	1.54	+.29	.0
Edmonton, Alberta	2,150	27.68	29.96	+.06	50.2	+.9	61.6	38.9	79	25	.95	−.38	T
Kamloops, British Columbia	1,262												
Victoria, British Columbia	230	29.82	30.08	+.07	55.0	+.2	62.1	47.9	73	42	1.39	−.77	.0
Barkerville, British Columbia	4,180												
Estevan Point, British Columbia	20												
Prince Rupert, British Columbia	170												
St. Georges, Bermuda	158		30.08	+.01	79.4	+1.6	85.0	73.8	88	71	5.85	+.29	.0
LATE REPORTS FOR AUGUST 1936													
Quebec, Quebec	296	29.61	29.93	0.00	62.7	−0.4	70.5	54.9	84	45	3.82	−0.01	0.0
Ottawa, Ontario	236	29.73	29.99	+.03	64.3	−.5	74.9	53.7	88	42	2.97	−.06	.0
Southampton, Ontario	656	29.34	30.05	+.06	64.8	+1.0	75.2	54.4	87	41	3.63	+1.38	.0
Minnedosa, Manitoba	1,690	28.20	29.98	+.04	63.1	+3.7	77.6	48.7	97	35	1.00	−1.10	.0
Qu'Appelle, Saskatchewan	2,115	27.72	29.93	.00	62.8	+1.3	77.5	48.2	96	35	1.35	−.29	.0
Moose Jaw, Saskatchewan	1,759				65.7		80.0	57.5	97	42	.64		.0
Swift Current, Saskatchewan	2,392	27.44	29.91	−.02	66.5	+2.5	79.8	53.2	97	41	1.56	−.35	.0
Medicine Hat, Alberta	2,365	27.50	29.94	+.02	69.1	+3.4	81.4	56.8	97	44	.84	−.83	.0
Calgary, Alberta	3,540	26.37	29.99	+.08	61.8	+2.4	74.9	48.7	89	42	1.51	−.63	.0
Battleford, Saskatchewan	1,592	28.26	29.97	+.06	64.6	+2.0	79.9	49.4	95	36	.67	−1.69	.0
Kamloops, British Columbia	1,262	28.66	29.92	+.01	69.8	+1.2	83.6	56.1	95	51	1.45	+.36	.0
Victoria, British Columbia	230	29.77	30.02	+.01	61.3	+2.6	69.1	53.5	82	48	.66	+.06	.0
Prince Rupert, British Columbia	170				58.4		65.8	50.9	76	47	4.30		.0

TABLE 3.—*Severe local storms, September 1936*

[The table herewith contains such data as have been received concerning severe local storms that occurred during the month. A revised list of tornadoes will appear in the Annual Report of the Chief of Bureau]

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Royal, Nebr.	1	2:30-3 p. m.	[1] 1		$5,000	Hail	
Nogales, Ariz.	1				1,000	Wind, rain, and hail	Damage to houses and trees.
Havana, Kans.[1]	1	About 5 p. m.			1,000	Windsquall	Several buildings damaged.
Nebraska City, Nebr. (5 miles west).	1	7:35 p. m.	667	0	25,000	Tornado	3 persons injured.
Tulsa, Okla.	2	7:55-8:20 p. m.	880		75,000	Wind	Crop damage negligible, principal loss at airport. 3 persons injured; length of path 8 miles.
Walla Walla, Wash., vicinity of.	3	5:50 p. m.		0		Tornado	Traveled over stubble field; blue-black funnel cloud extended up to a brownish colored cloud that covered ⅗ of the sky. When funnel cloud left the ground, it assumed a horizontal position, shortly to break into 2 sections; lower section seemed to "explode" and disappear. Direction of travel northeast.
Platte and Goshen Counties, Wyo., northern sections.	3-4					Heavy rains	Considerable loss to livestock by drowning.
Starbuck, Minn.	5	9:30 p. m.				Severe thundersquall	6 persons injured.
West Point, Nebr.	6	5 p. m.	667		500	Hail	
Hancock County, Iowa	6	5-8 p. m.			[cb] 20,000 5,000	Wind and hail	Considerable damage throughout county, particularly in Madison, Crystal, Avery, Britt, and Magor townships.

See footnotes at end of table.

TABLE 3.—*Severe local storms, September 1936*—Continued

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Sioux County, Iowa	6	5 p. m.	[1] 1	0	$15,000	Wind and hail. Probable tornado.	Wind damage property at Sioux Center. Wind reached tornadic proportions. Buildings on 12 farms south of Primghar wrecked; no injuries reported.
O'Brien County, Iowa (adjacent to and east of Sioux County).							
Crawford County, Nishnabota Township, Iowa.	6	5 p. m.			[a] 500 5,000	Wind and hail.	Extent of crop damage unknown.
Pine Island and vicinity, Minnesota.	6	5:45 p. m.	[1] 10		50,000	Severe thundersquall	Mostly rural property damage, some corn lodged. Length of path, 20 miles.
Humboldt County, Iowa	6	6:30 p. m.	110	0	700 4,300	Wind. Tornado.	Wind damaged transmission lines and farm equipment in vicinity of Humboldt. Developed into a tornado at Renwick; buildings damaged $3,000, crop $500, and livestock $800.
Wright County, Iowa	6	6:30–7 p. m.			25,000	Wind.	Some damage throughout county, particularly to buildings at Belmont, Clarion, and Eagle Grove; corn flattened.
Franklin County, Hampton and Sheffield, Iowa.	6	Early evening.			10,000	do.	Damage throughout county; $5,000 damage to buildings in Sheffield.
Floyd County, Union, Rock Grove, and Scott Townships, Iowa.	6	6:30–8 p. m.		0	[b] 15,000 [c] 10,000	Wind and tornado.	Possibly continuation of Franklin County storm. Winds reached tornadic proportion southwest of Rockford for a short time, then subsided into straight winds.
Cerro Gordo County, Iowa	6	7 p. m.			125,000	Wind.	The most destructive storm of the series, some places evidence of "twisting." Figures denote loss in Mason City–Clear Lake area.
Chickasaw and Bremer Counties, Iowa.	6	Evening.			5,000	do.	Continuation of Floyd County storm. Two persons injured in Chickasaw County.
Winneshiek County, Bluffton Township, Iowa.	6	7 p. m.			1,000	Electrical and wind.	Livestock killed by lightning; corn flattened.
Bison, Kans.	8				4,300	Windsquall.	Details lacking.
North Branch and vicinity, Minn.	10	1:30 a. m.	[1] 5		[c] 10,000 10,000	Hail.	Damage to roofs and growing crops.
Woodruff, S. C.	10	Afternoon.			1,000	Electrical.	Lightning set fire to warehouse.
Grand Rapids, Mich.[2]	11					Heavy rains.	Considerable damage to goods stored in basements.
Chicago, Ill.	11	7:59 p. m.				Wind, electrical, and excessive rain.	Street and basements flooded; some wind and lightning damage.
Polk County, Iowa	12	3:30 p. m.			2,000	Wind, hail, and electrical.	Wind uprooted trees, poles, and unroofed buildings; some damage caused by lightning at Des Moines.
Jasper County, Iowa	12	3:30 p. m.			3,000	do.	1,500 panes of glass broken in one greenhouse by hail. Near Newton, lightning set fire to a building.
Chicago, Ill., and vicinity of [3]	13					Thunderstorm and excessive rain.	Basement, streets, subways, and outlying roads flooded.
Toledo, Ohio	13–14	10:50 p. m.–8:58 a. m.				Thunderstorm.	Lightning struck 12 houses; also considerable damage from heavy rain.
Lake County, S. Dak.	14	Near midnight.				Windstorm, accompanied by rain.	Wind destroyed several barns near Wentworth.
Delaware and Fayette Counties, Iowa.	15				1,000	Wind and hail.	
Chicago, Ill., and vicinity [3]	15	P. m.				Thunderstorm and excessive rain.	Streets, basements, and underpasses flooded.
Redwood, Lyon, and adjacent counties, Minn.	14	5:30 p. m.	880		40,000	Severe thundersquall and heavy rain.	Mostly rural property damage; some livestock and poultry killed; corn lodged; 1 person injured.
Sioux County, Iowa	14	6 p. m.			600	Wind and hail.	Thunderstorm attended by wind and hail caused slight damage in 2 townships.
Milwaukee, Wis., and vicinity	15					Thunderstorm.	Wind and lightning incurred considerable damage.
North Carolina; coastal region from Hyde County north to Virginia line.	17–18				60,000	Tropical storm.	Loss to buildings, fishing equipment, and roads. Slight damage to crops.
Chincoteague, Va.	17–18			5	100,000	do.	
Northampton and Accomac Counties, Va.					[d] 250,000	do.	Oyster bed wrecked, 60,000 chickens lost, and late crops destroyed.
Cape Charles, Va.					250,000	do.	
Norfolk, Va.					[3] 25,000		
				2	[d] 500,000		In Norfolk area damage to business, residential, and marine property due to high wind and high tide.
					500,000		
Eastern Shore	18			*7	100,000 50,000 30,000 11,900 [d] 83,000	Tropical storm.	Property damage at Ocean City, Md. Damage to rural property and livestock. Loss to fishing fleets. *Death by drowning. Loss to transmission lines.
Long Island, N. Y. (east portion).	18–19					do.	Many boats damaged.
Block Island, R. I.	18–19	7 p. m.–3 a. m.			4,700	do.	Loss mostly to marine equipment.
Hobbs, N. Mex. [2]	20–21					Heavy rainstorm.	Maximum flood depth in business section.
Golden, Okla. (near)	22	4:30 p. m.	880	0	[d] 500 15,000	Tornado.	2 farm houses destroyed; strip of timber ½ mile wide uprooted 6 persons injured. Length of path 1 mile; direction of travel southwest to northeast.
Barton County, Mo., Lamas and Irwin.	23	3 p. m.		0		do.	Much damage to house, barns, transmission lines, and shocked fodder. Funnel-shaped cloud observed.
Springfield, Mo.	23	Afternoon.			10,000	Wind.	1 house demolished, 4 partially destroyed. No injuries reported.
Lowndes County, Miss., vicinity of Columbus.	23				3,000	Wind, hail, and electrical.	No details.
Canton, N. Y.	23				500	Electrical.	1 building struck by lightning.
Fremont, Natrona, Albany, and Platte Counties, Wyo.	25–26					Heavy snowstorm.	
Regina, N. Mex.	26	10 a. m.	[1] 7		3,000	Hail.	Maximum size, ¾ inch.
Jemez Springs, N. Mex.	26	2 p. m.	[1] 15			Hailstorm.	Property damage.
Central mountain area, New Mexico.	26–27			*4		Snowstorm.	Maximum snow depth 18 inches. Deaths due to exposure. 1 person injured by building collapse.
Colorado; eastern slope and and much of mountain sections.	26–28			*7	*7,000,000	Heavy snowstorm.	New record snowfall established in many districts. 15 inches of snow recorded at the Denver Weather Bureau Office on the 28th. Figures denote damage in Denver and vicinity; deaths from air and automobile traffic.
Dallas, Tex., and vicinity	26–27	5:30 p. m.–2:45 a. m.			20,000	Electrical and excessive rain.	Losses incurred by lightning and excessive rain.
Golden, Okla. (near)	27	4:30 p. m.	880	0	1,500	Tornado.	2 farm houses destroyed; 6 persons injured. Path 1 mile long, direction of motion southwest to northeast.
El Paso, Tex.	27		[1] 3–4		[e] 1,000	Thunderstorm accompanied by hail.	Path 50 miles long.
Extreme northwestern counties, S. C.	30				[c] 10,000 140,000	Heavy rains, resulting floods.	28 county bridges washed out in Oconee County.

See footnotes at end of table.

TABLE 3.—*Severe local storms, September 1936*—Continued

LATE REPORTS FOR AUGUST 1936

Place	Date	Time	Width of path, yards	Loss of life	Value of property destroyed	Character of storm	Remarks
Montgomery County, Kans.	1	5 p. m.	[1] 1	0	$25,000	Tornado	Chief damage at Havana, several buildings damaged or demolished. Length of path 2½ miles.
Meeker and McLeod (north portion) Counties, Minn.	9–10	Midnight–2 a. m	[1] 3–4	.....	20,000	Hail and wind	Property and crop loss.
West-central and extreme southeastern counties, Minn.	15	3:30–8:30 p. m.	.....	.....	200,000	Severe thundersqualls	Storm preceded by severe dust squalls; principally property loss; heaviest losses in vicinity of Twin Cities.
Eureka Springs, Ark.	17	.....	.....	.....	1,000	Electrical	Barn destroyed by lightning.
Silver Bow County, Mont.	20	Afternoon	.....	.....	75,000	Hailstorm and cloudburst.	Hail loss negligible; figures denote loss from floods.
Baltimore, Md.	21	.....	.....	.....	20,000	Severe thundergusts	Property loss incurred by wind.
Howard County, Md.	21	.....	.....	.....	12,000	Electrical	Damage from lightning.
Elk City and Washington, Kans.	22	.....	.....	0	.....	Small tornado	A number of buildings wrecked in both towns.
Seminole County, Okla.	23	3:30–4:30 p. m.	[1] 12	.....	2,625	Wind	Loss to property; path 15 miles long.
Fairview and Clear Springs, Md., and vicinity.	25	5 p. m.	.....	.....	[c] 5,000	Heavy hail	Loss of crops in vicinity of Clear Springs; maximum size of hailstones 1 inch in diameter.
Greensboro, Md. (near)	25	.....	.....	.....	600	Electrical	Barn destroyed.
Rock, Nobles, Jackson, Martin, and Brown (south portion) Counties, Minn.	27	5 p. m.	.....	.....	100,000	Heavy hail	Considerable damage to corn.
Baltimore, Talbot, and Queen Annes Counties, Md.	29	.....	.....	.....	1,800	Electrical	Property and livestock loss.

[*] See remarks for qualifying statements.
[1] Miles instead of yards.
[2] From press reports.
[3] Official reports augmented by press reports.
[c] Loss to crops.
[h] Loss from hail.
[t] Loss by tornado.
[w] Loss by wind.
[ch] Crop damage from hail.

U. S. GOVERNMENT PRINTING OFFICE: 1936

Chart I. Departure (°F.) of the Mean Temperature from the Normal, September 1936

Chart I. Departure (°F.) of the Mean Temperature from the Normal, September 1936

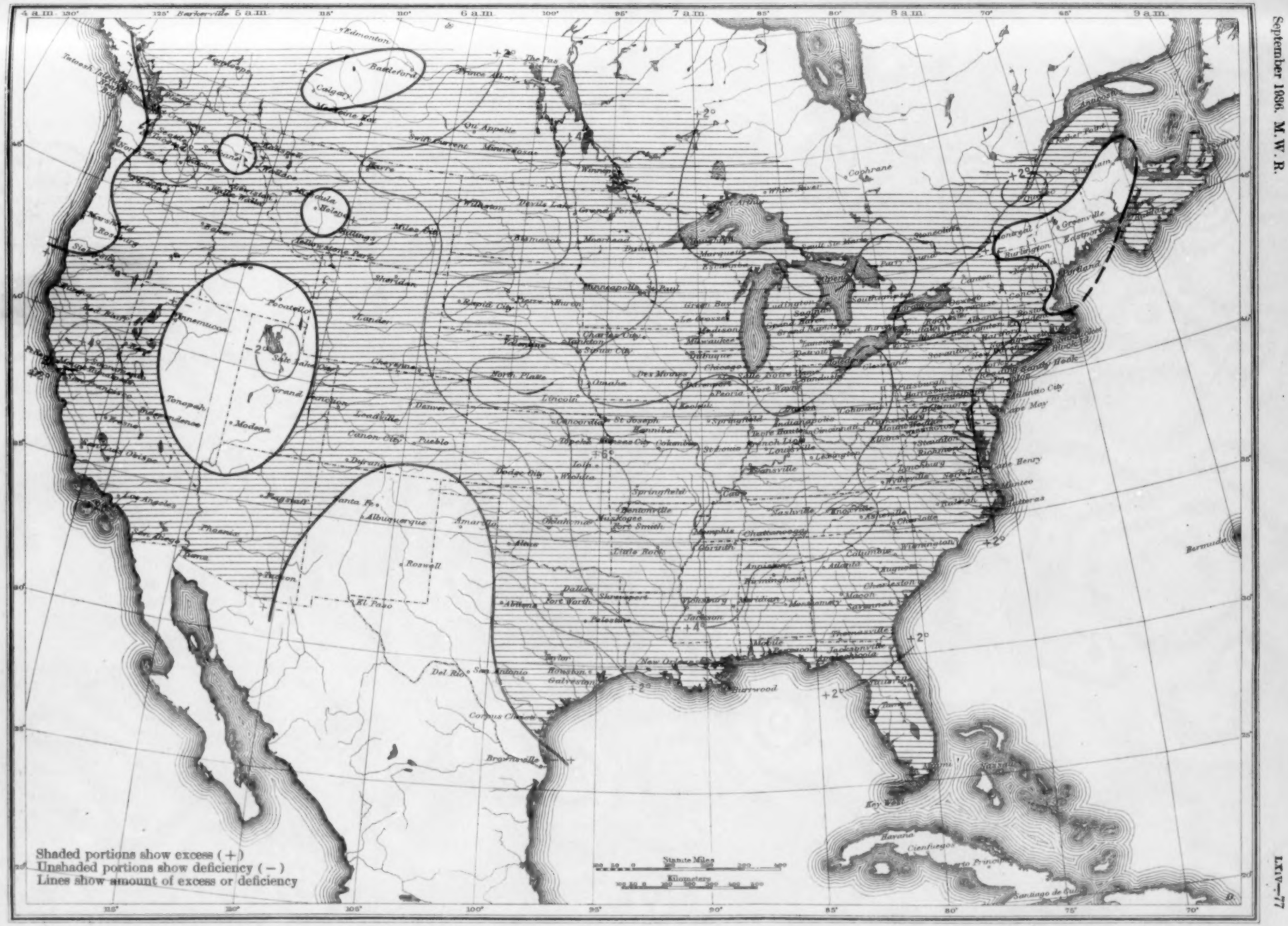
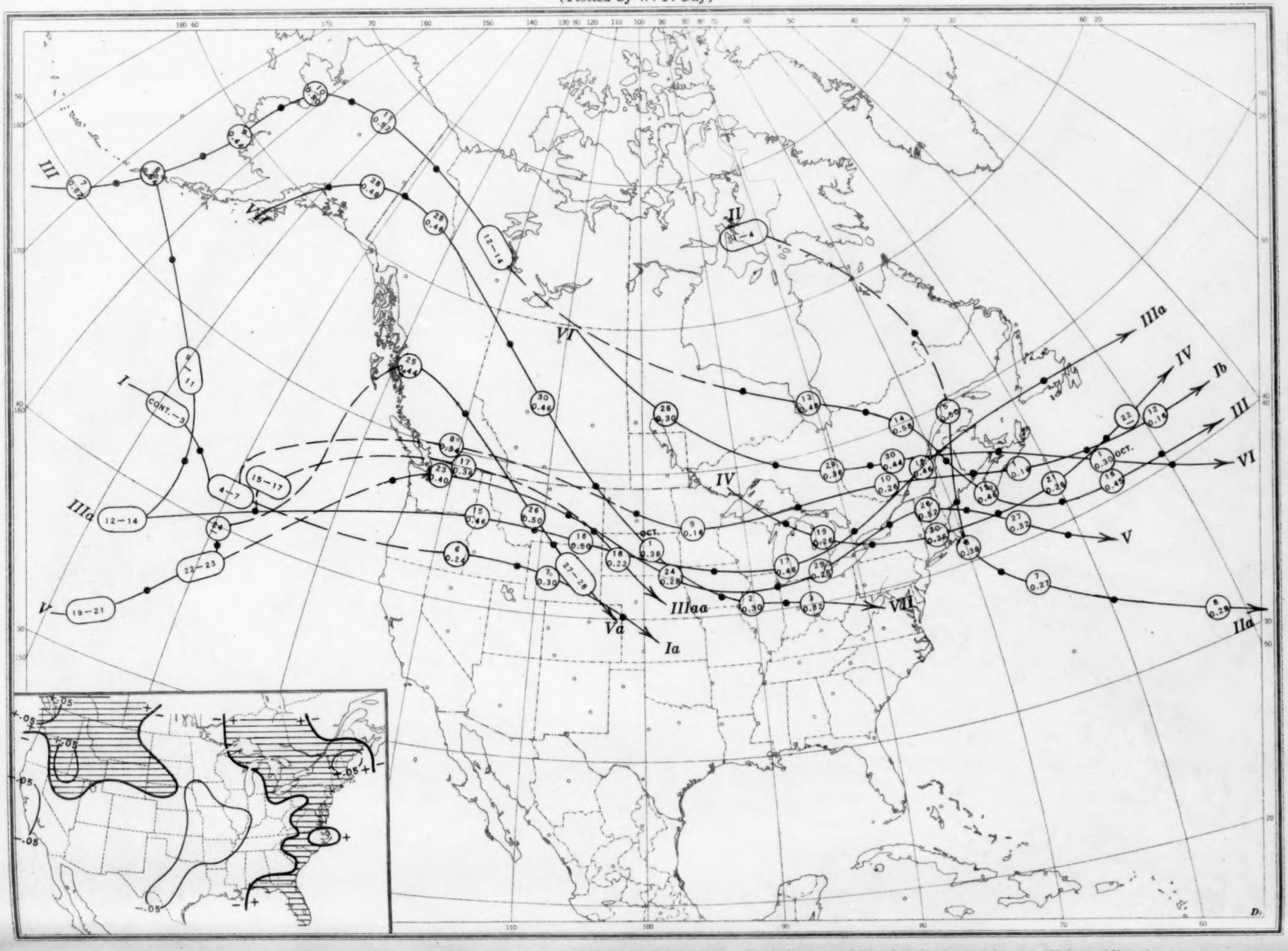

Shaded portions show excess (+)
Unshaded portions show deficiency (−)
Lines show amount of excess or deficiency
Statute Miles
Kilometers

Chart II. Tracks of Centers of Anticyclones, September 1936. (Inset) Departure of Monthly Mean Pressure from Normal

(Plotted by W. P. Day)

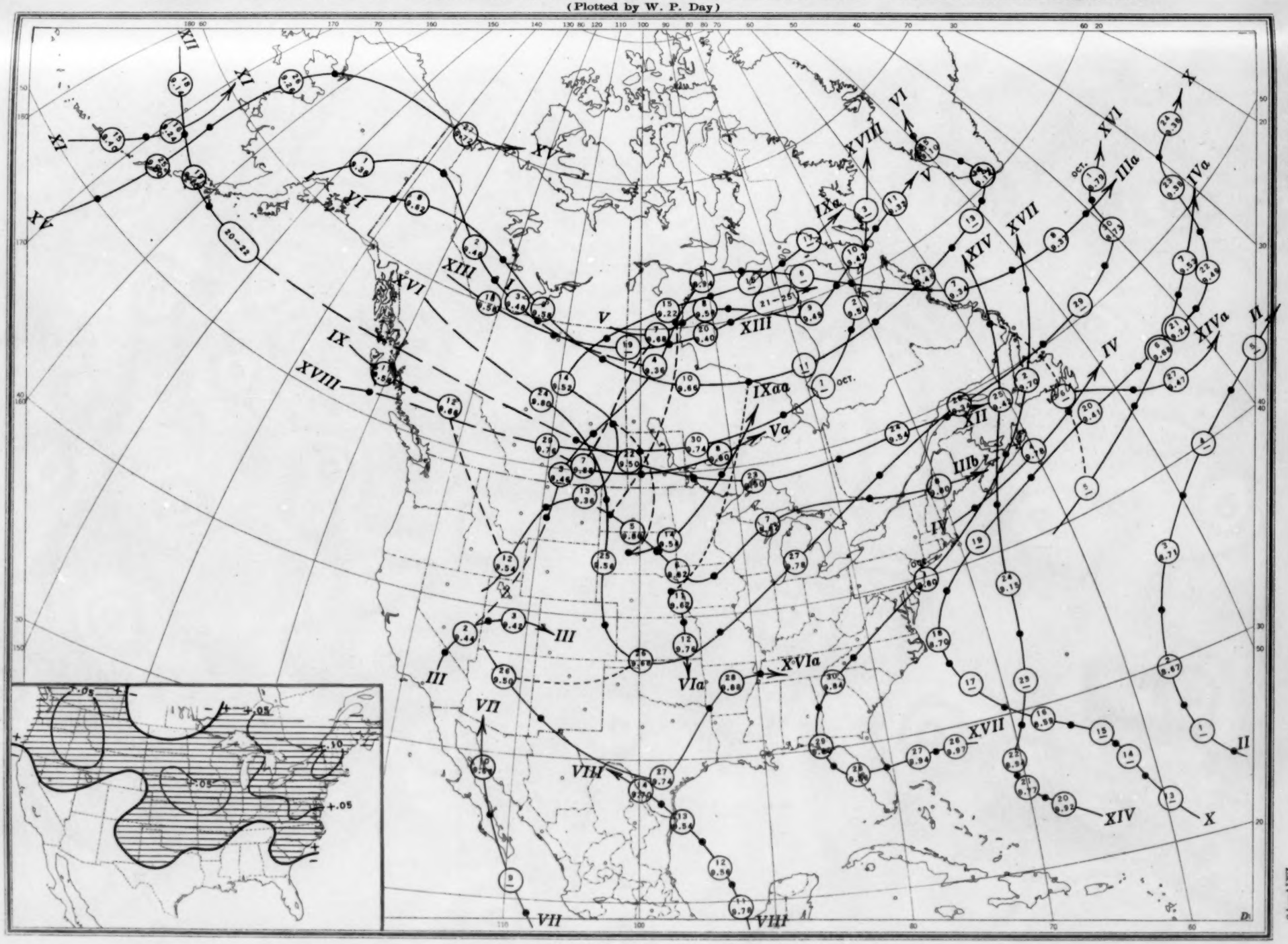


Circle indicates position of anticyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 8 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, September 1936. (Inset) Change in Mean Pressure from Preceding Month

Circle indicates position of anticyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of anticyclone at 8 p. m. (75th meridian time).

Chart III. Tracks of Centers of Cyclones, September 1936. (Inset) Change in Mean Pressure from Preceding Month
(Plotted by W. P. Day)



Circle indicates position of cyclone at 8 a. m. (75th meridian time), with barometric reading. Dot indicates position of cyclone at 8 p. m. (75th meridian time).

Chart IV. Percentage of Clear Sky Between Sunrise and Sunset, September 1936

Chart V. Total Precipitation, Inches, September 1936. (Inset) Departure of Precipitation from Normal

Chart V. Total Precipitation, Inches, September 1936. (Inset) Departure of Precipitation from Normal

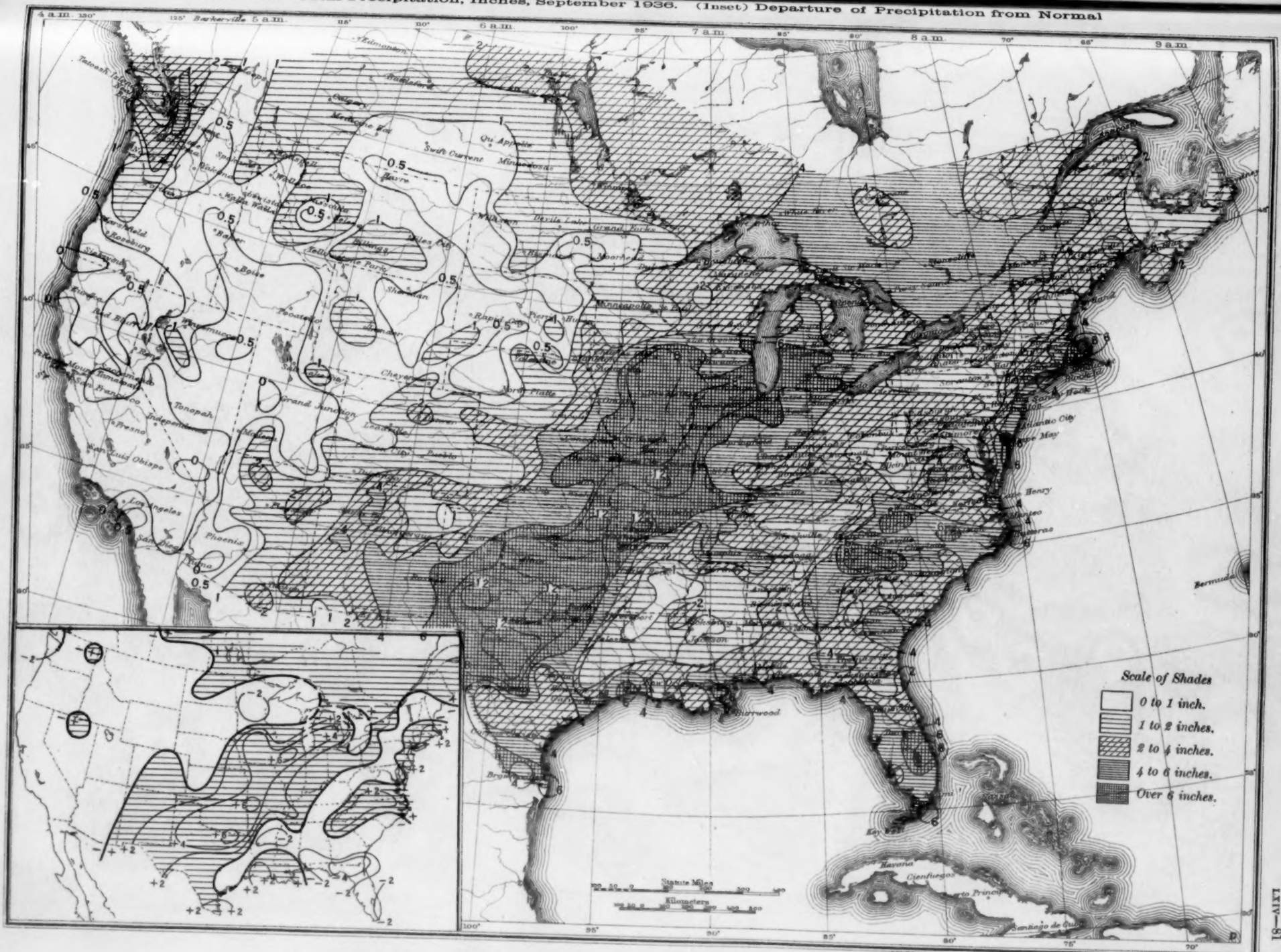


Chart VI. Isobars at Sea Level and Isotherms at Surface; Prevailing Winds, September 1936

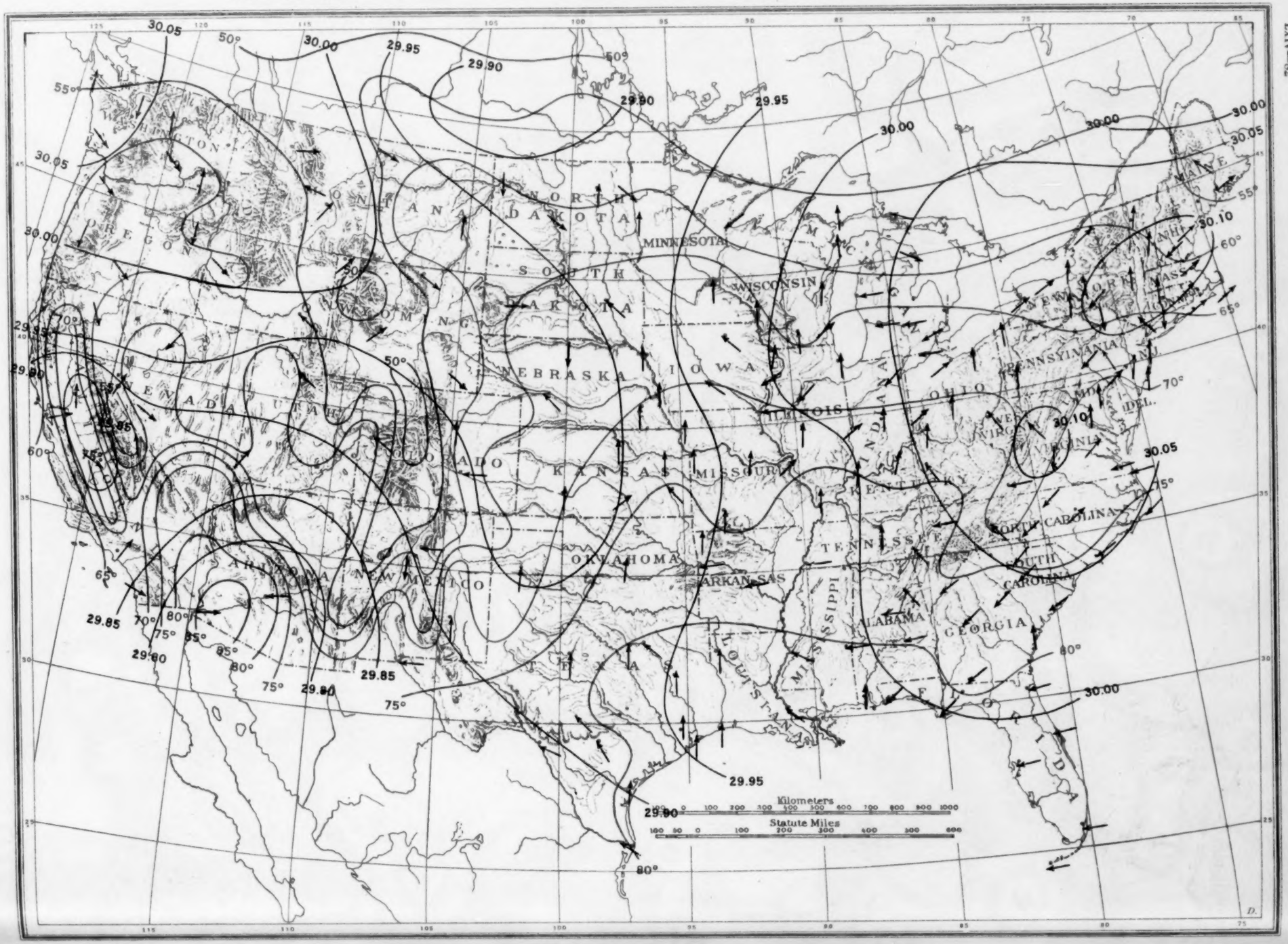


Chart VII. Wind Roses for Selected Stations, September 1936

(Plotted by W. W. Reed)

Chart VII. Wind Roses for Selected Stations, September 1936

(Plotted by W. W. Reed)

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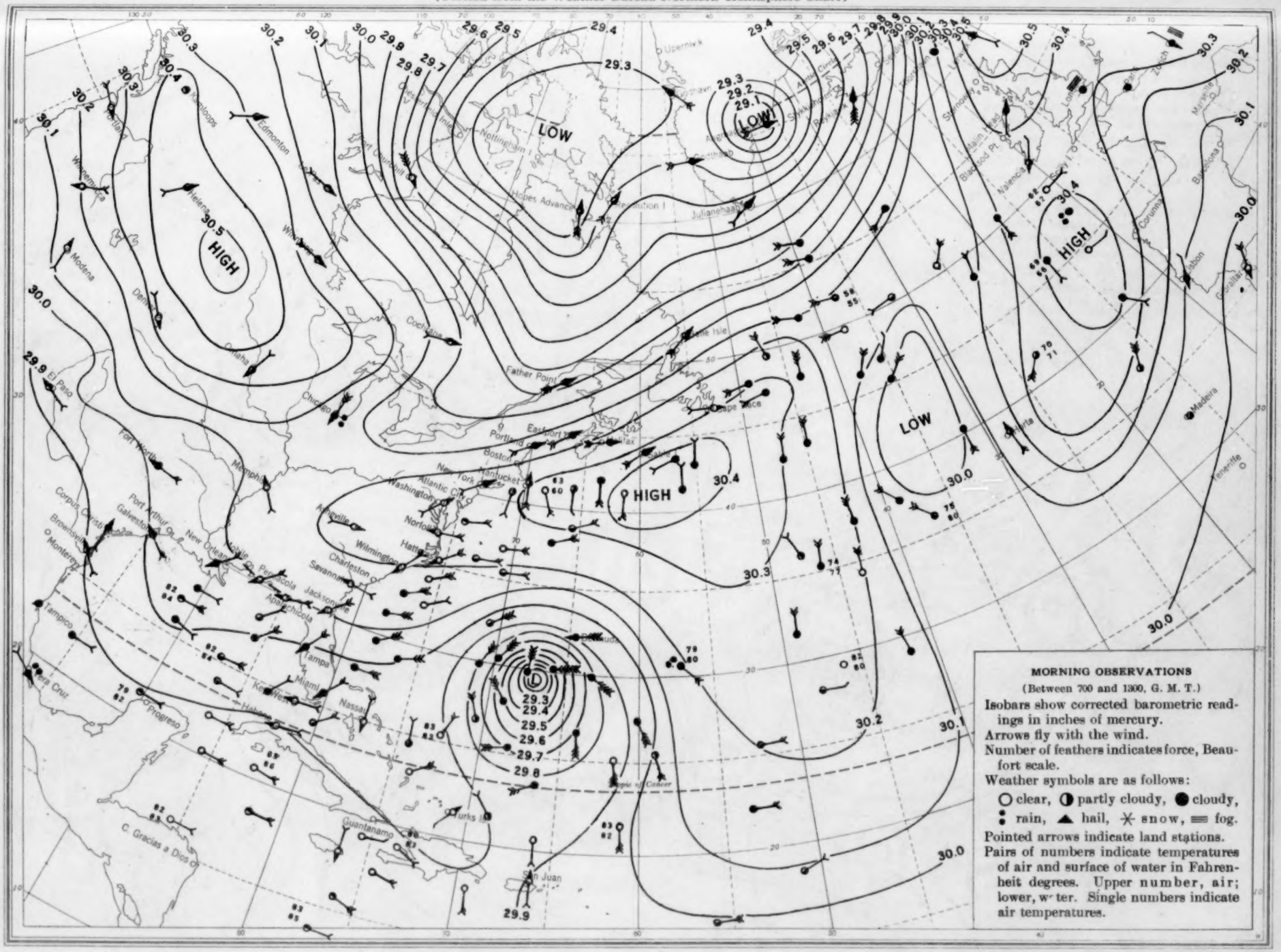
Chart IX. Weather Map of North Atlantic Ocean, September 15, 1936
(Plotted from the Weather Bureau Northern Hemisphere Chart)

Chart IX. Weather Map of North Atlantic Ocean, September 18, 1936

(Plotted from the Weather Bureau Northern Hemisphere Chart)



MORNING OBSERVATIONS

(Between 700 and 1300, G. M. T.)

Isobars show corrected barometric readings in inches of mercury.

Arrows fly with the wind.

Number of feathers indicates force, Beaufort scale.

Weather symbols are as follows:

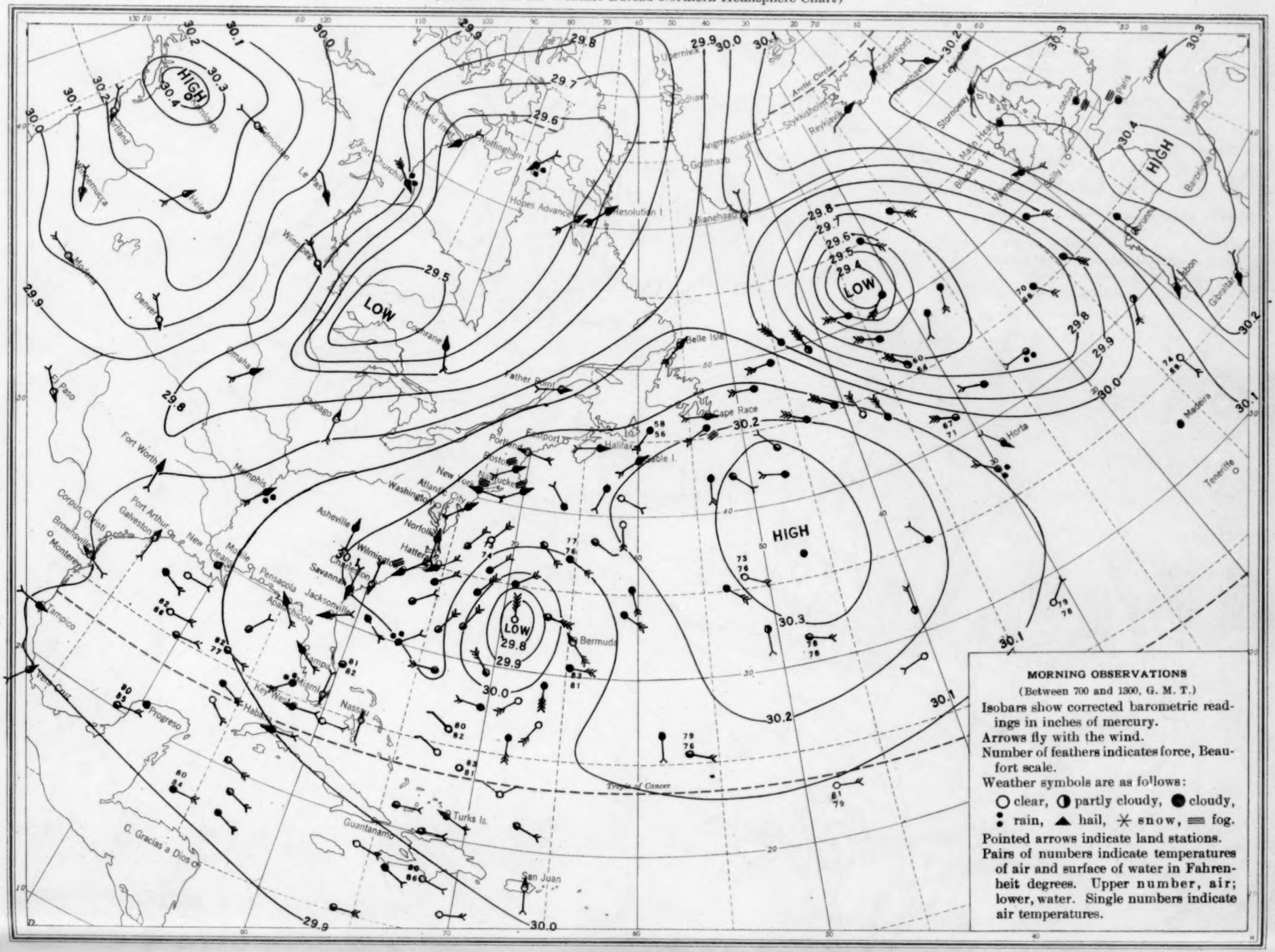
○ clear, ◑ partly cloudy, ● cloudy, ⁝ rain, ▲ hail, ✳ snow, ═ fog.

Pointed arrows indicate land stations.

Pairs of numbers indicate temperatures of air and surface of water in Fahrenheit degrees. Upper number, air; lower, water. Single numbers indicate air temperatures.

Chart X. Weather Map of North Atlantic Ocean, September 23, 1936.

(Plotted from the Weather Bureau Northern Hemisphere Chart)



MORNING OBSERVATIONS

(Between 700 and 1300, G. M. T.)

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Weather symbols are as follows:

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• rain, ▲ hail, ✳ snow, ≡ fog.

Pointed arrows indicate land stations.

Pairs of numbers indicate temperatures of air and surface of water in Fahrenheit degrees. Upper number, air; lower, water. Single numbers indicate air temperatures.

Chart XI. Tracks of Centers of Tropical Disturbances, September 1936

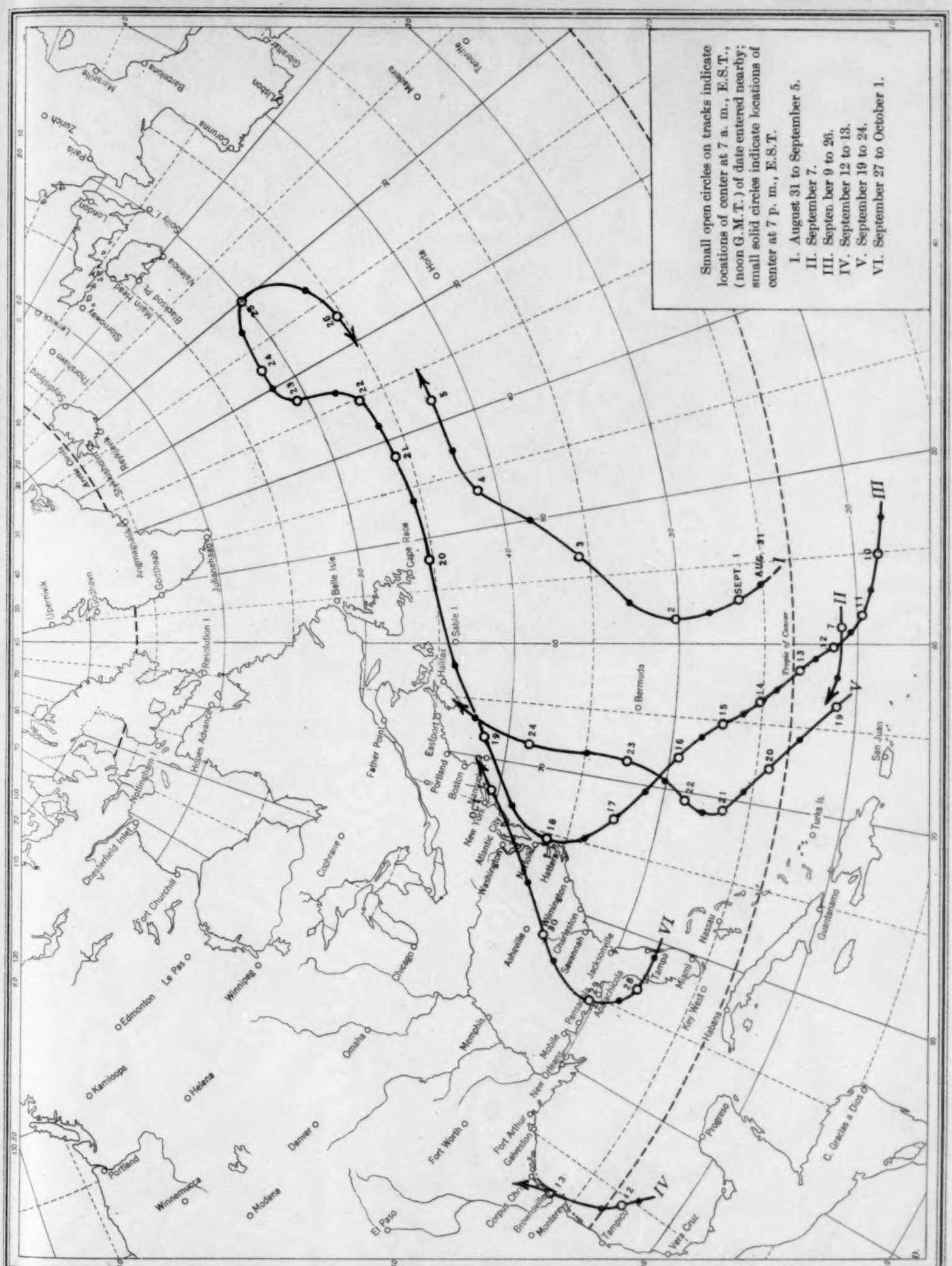

Chart XI. Tracks of Centers of Tropical Disturbances, September 1936